FOOD MANUFACTURE

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A JOURNAL DEVOTED TO THE PRODUCTION AND MANUFACTURE OF ALL EDIBLE COMMODITIES INVOLVING A PROCESS OF MANUFACTURE.

FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

VOLUME . . . XV

NUMBER . . . 2

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The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

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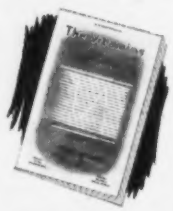

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T.G.S.

← *Facing first page of Editorial*

FOOD MANUFACTURE

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Legerdemain

IT MUST be seldom that recourse is had to the arts of the "magician" in connection with the adulteration of food. In a recent case, communicated to the *Analyst* by F. E. Needs, two samples of milk were found to be watered and, at the farmer's request, his herd of ten cows were milked in the presence of two inspectors for the purpose of taking samples for analysis. The farmer, when bending over the pail during this operation, was seized with a violent fit of coughing, during which he apparently introduced water from a bottle concealed in the folds of his apron. The quickness of the hand did not in this case deceive the eye and the conjuring trick cost the farmer £50 with 10 guineas costs.

Orange Juice and Calcium Assimilation

It has been suggested by earlier workers that the retention of calcium in children is facilitated by orange juice, and C. S. Lanford (*J. Biol. Chem.*, 1939, **130**, 87-95) has made some further tests in which a group of young rats was given a small supplement of orange juice in addition to the basal diet of wheat and milk, another group serving as control and given the basal diet only. It was found that the proportion of calcium stored in the body was 8 per cent. greater in the group that received the orange juice than in the control group. It was also noticed that the animals given orange juice grew about 10 per cent. more rapidly than the controls.

Wrapped Butter Deterioration

Air and light are harmful to butter, air because oxygen reacts with the most easily oxidisable components and light because the oxidation is accelerated. The most active wavelengths are at the orange and red end. A green filter, screening out the most harmful rays, gives some protection, but the most effective protection from light is aluminium foil lined with parchment paper. If butter remains long wrapped in the foil, even when it is fully lined, it gradually acquires a metallic taste. Spoilage by oxidation can be greatly retarded by making the butter in an atmosphere of nitrogen, but storage in this gas favours the growth of anaerobic micro-organisms. The colour of butter is sometimes impaired by loss of water at the surface due to phase separation in the butter fat emulsion.

Saccharin Again

During the last war we became accustomed to the sight of small pellets being abstracted from little tubes and dropped into cups of tea or coffee. Once again the advent of rationing reminds us that the allowance of sugar is insufficient for many people's requirements. It should be remembered that such articles as dried fruits, at present available in ample quantities, should help to satisfy the "sweeet tooth". Although sugar is a source of energy this is not the sole reason for its consumption. It is also used as a condiment. As a source of energy its place can be largely taken by other carbohydrates. Two-thirds of the ration can well be used in tea and coffee, and there is no reason why saccharin should not be widely employed as a beverage sweetener. It is a synthetic product which could be made in any quantity and could replace large amounts of sugar and so release this for making jam or marmalade. It is more expensive than sugar, but with an increased demand costs of manufacture might be reduced. Its degree of sweetness is much higher than sugar and one-third grain is equal to the average lump of sugar. One way of using it might be to incorporate a proportion of saccharin in sugar, thus making one lump take the place of two.

By-Products in Meat Industry

The handling of the by-products of the abattoir is a business in itself, and the prices of such products may, as is obvious, affect livestock prices. The list of by-products is quite a large one, ranging from the ear hairs to the hoofs and from the end of the tail to the horns, in the case of cattle. Scientific methods are used for the elaboration of a host of products, edible and inedible. There is still a wide field for research in these matters. Considerable interest was evinced in the article on the separation of blood plasma for sausages which appeared in the September, 1939, issue of FOOD MANUFACTURE. Here is an example of a valuable food product which has largely either been wasted or misapplied. It behoves us to try to develop new products which make new uses for by-products, which themselves must be handled in an efficient and economical way.

Preventing Oil Separation

A method for the prevention of the separation of oils and solids-not-fat has recently become the subject of a U.S. patent. It has been found that the addition of small percentages of glycerine to peanut butter not only prevents the separation of oil, but enables the product to be ground to a smoother and finer consistency. The amount of glycerine necessary to be used for the purpose is not sufficient to affect the flavour of the finished product. Glycerine is, of course, not unknown as a food ingredient, but its particular function above mentioned appears to be a new discovery and possibly may suggest research on problems connected with the preparation of other articles of food.

Milk Pasteurisation

The non-pasteurisation school had a useful little bit of propaganda in a recent broadcast from a gentleman who hadn't had a cold for 14 years or so, and who divulged his secret. There was quite a lot to it, although it must have disappointed those who imagined it might be some kind of special pill or potion, and part of it, perhaps the most important part, concerned diet. And milk was part of the diet. Unpasteurised milk. There was just a trifle of emphasis on the "unpasteurised". There is no doubt about the propaganda value of wireless talks—so what about a word from the pasteurised milk adherents?

The "natural food" people have some quite strong points, especially when they are on safe ground such as rice polishings, potato skins and suchlike, but it is somewhat puzzling to attempt to delve into the mind of a recent writer on naturopathy who, in the course of a well-balanced article, spoils it by saying, "Sugar is processed until a knob of coal would have more food value". It were idle to speculate what exactly he means by this, as it means . . . nothing.

Cucumber Pickle Fermentations

Some work done by M. K. Veldhuis and John L. Etchells of the United States Division of Agriculture may be of interest to pickle manufacturers and their chemists.

The normal fermentation of cucumber pickles in salt brines is accompanied by the evolution of considerable quantities of gases. In connection with the fermentation of the pickles in experimental vats, studies on these gaseous products were made. Brines of initial concentrations of 20, 30, 40, 60, and 80 per cent. saturation with respect to salt were used. With the exception of the 80 per cent. saturated brine, the brine concentrations were increased at definite intervals so that 70 per cent. saturation (18·5 per cent. sodium chloride) was reached in six weeks.

Chemical analyses for carbon dioxide, hydrogen, and oxygen were made at intervals during the evolution of gases. The composition of the gases and the duration of gas evolution were related to the initial brine concentration. Carbon dioxide was found in the gases from all brine concentrations. A relatively large portion of the gases evolved from the fermentations in 60 per cent. saturated brines was found to be hydrogen. The gases found in the interiors of hollow cucumber pickles were analysed and found to be similar in composition to gases collected at the same time at the surfaces of the brines.

Meat Softeners

Tenderising meat has been in the news during the past year or so, and some excellent results have been obtained by the use of ultra-violet radiation. Other means have been tried, including a refinement of the time-honoured one of bashing a steak with a rolling-pin. This consists of a device which penetrates meat deeply in a series of fine parallel perforations. A. Besson (*Ann. Falsificat.*, 1939, **32**, 260-263) has found that the use of such instruments may inoculate meat with putrefactive micro-organisms or even those of the salmonella group.

Cooking is effected at a temperature lower than sufficient to destroy these bacteria or toxins, especially when it consists of grilling or roasting. Since 1936 the manufacture, sale and putting on sale and the use of such articles in all places where raw and cooked meat is offered for sale has been forbidden by a French statute. On February 14, 1938, this prohibition was confirmed and extended to the whole country with regard to meat softeners of the type described.

Rickets and Cereals

In 1920 Mellanby pointed out that cereals may produce rickets in young animals, and that an increase of cereals in diets deficient in antirachitic vitamin accentuated the symptoms of rickets. He then suggested that cereals speeded up the growth of the animals without supplying the necessary quantities of calcium and phosphorus required for the bones. This explanation has since been found to be inadequate, although there is some truth in it. On the whole, the cereals with the largest content of calcium and phosphorus, such as oatmeal, maize and wheat germ, cause the lowest retention of these elements in the bones and teeth. A large part of the organic phosphorus of cereals is in the form of phytic acid in combination with calcium and magnesium. Phytin itself is not absorbed in the alimentary canal and it is utilised by a breakdown into inositol and phosphoric acid. Recently Harrison and Mellanby have investigated the effect of feeding phytic acid and its crystalline alkaline salt to dogs. Both were highly rachitogenic when added to a border-line diet and the action was comparable to that of oatmeal of similar phytin content. The rachitogenic action is antagonised by adding extra calcium to the diet. Palmer and Mottram claim that the tendency of cereals to produce rickets is due to their low calcium and high phosphorus content. This is counteracted by adding calcium lactate so that the ratio Ca : P is 1 : 0·5. The rickets-producing action of cereals can be overcome not by increasing the phosphorus content but by increasing the calcium intake, as, for example, by drinking more milk. Scotsmen seem to have made this discovery empirically years ago when they took their oatmeal porridge with copious draughts of milk.

Potato Feed

The first months of the war have seen an acute shortage of feeding stuffs in certain parts of the country owing to the curtailment of imported offals. This has applied especially to East Coast districts and East Anglia. During war time potatoes have a special significance as a substitute in animal feeding for the carbohydrates such as barley and maize meal. When potatoes are fed to livestock, however, certain precautions must be taken, and the Ministry of Agriculture's new "Grow More" Leaflet (No. 10—Unsaleable Potatoes: Their Use in Animal Feeding) explains what should be done in this direction, as well as setting out some specimen rations that include potatoes for beef and dairy cattle, sheep and pigs. The precautions are quite simple and consist chiefly of boiling or steaming the potatoes, slicing to eliminate risk of choking and avoidance of excess in feeding. The tubers must also be clean. Observance of the recommendations will make it quite safe to use damaged potatoes or tubers slightly blighted or holed by wireworm. Damaged or diseased potatoes cannot be stored in clamps and the most practical way of storing them on the farm for stock feeding is in a silo pit. Full details of the method are given in the leaflet.

Nutrition Problems

The chief medical officer to the Ministry of Health has devoted much space in his report to problems of nutrition. This is a welcome sign and shows that the policy of his predecessor is being followed on the axiom that nutrition is the foundation of public health. The chief work of the Advisory Committee on Nutrition has been consideration of budgets collected by the Ministry of Labour, the distribution of the population of Great Britain into income groups and the institution of dietary surveys. They propose to express the nutrients in the diets surveyed as consumption per head. They also propose to adopt for calories and proteins a calculation per "man value". It is doubtful if this calculation will have any real significance, even in regard to calories, and for protein it may be misleading, as there are so many standards of the relation of the needs of children and adolescents to those of adults. It is not possible to express the needs of children for the different constituents of diet as fractions of the adult male's diet. Experiments involving the giving of supplementary foods belonging to the protective groups are making satisfactory progress. Reference is made to the Food and Drugs Act, 1938, and to the possibility under that Act of the Minister of Health making regulations as to the composition of foods. It is time the general public had some protection against the use of misleading labels and advertisements. The Ministry

has powers under the Act (section 6) to stamp out extravagant and mendacious claims, but these powers must be applied fearlessly and ruthlessly.

Vegetarians will gloat over the section on meat inspection. Even we were horrified to learn that dead one-day-old chicks or dead unhatched chicks have been used for the making of chicken paste for pie fillings in the Midlands. No wonder a Ministry of Health is necessary.

Vitamins and Vitamin Products in Whey

Whey or milk serum, following removal of the fat and casein, may serve as the starting material for the further isolation of lactalbumin, milk sugar, milk phosphates, mixed sterols, cholesterol, fat-soluble vitamin K (prothrombin), and water-soluble vitamins, particularly commercial quantities of lactoflavin (riboflavin). The presence of an estrogenic substance has been demonstrated in fractions derived from whey, according to a paper read before the American Chemical Society by G. C. Supplee.

The multiplicity of vitamins found in the whey fraction after removal of protein and milk sugar is adequate in water-soluble factors to support growth, reproduction, and lactation. Eight successive generations of white rats have been maintained with a normal life cycle on a restricted experimental diet in which the whey vitamin fraction supplemented with rice polish served as the sole source of all vitamins except the fat-soluble factors carried by a small percentage of cod liver oil.

Scarcity of Rennet

During the last fifty years the commercial extract of rennet, prepared in special laboratories, has entirely superseded the old-fashioned coagulating fluid which the cheesemaker obtained by soaking calves' stomachs in water. In the early days the stomachs, or rennets, were procured from the patrons of the cheese factory, but later a better-cured article was obtained from Continental Europe, chiefly from Poland. The manufacturers of extract have depended upon the European supply of rennet for their raw material, but that source has been cut off by the war. In Canada, at least, there is some danger of a real shortage, which would be disastrous for the cheesemaking industry, according to a publication (No. 676) of the Canadian Department of Agriculture.

There is no reason why Canada's needs in this respect cannot be supplied locally if farmers, butchers, and packing-houses save all the stomachs of calves which are slaughtered at the right age. The publication gives full directions of the methods of saving and preparing calves' stomachs, and includes a couple of sketches showing exactly which parts are useful. The directions were supplied by one of the principal manufacturers of rennet extracts. As British households consume large amounts of Canadian cheese, the matter is of more than Canadian interest.

Rationing

By the time this note appears rationing will have been in force for three weeks. Butter, bacon and sugar were rationed from January 8 and meat will come under the order this month. In the meantime, the regulations have been modified twice. The original weekly ration for uncooked bacon and ham was 4 oz., but on January 26 it was announced that, owing to an improvement in the stock position, it would be increased on January 29 to 8 oz.

We had deplored the fact that it had not been made obligatory that all margarine be vitaminised, and it was welcome news that reached us at the moment of going to press that, as a result of a conference between the manufacturers and the Ministry of Food, all margarine, other than that used for manufacturing purposes, will incorporate vitamins A and D in the same quantity as they are found in butter. There is no doubt but that most people will need to supplement their butter ration with margarine, and the added vitamins will aid in the prevention of serious disorders. The last war demonstrated that sources of vitamin A should be replenished by vitaminised margarine, liver, sardines, spinach and, of course, fish liver oils. The rationing of meat will not be so serious so long as we have plentiful supplies of milk and cheese, and there are always the edible offals which are not to be rationed. As a source of protein cheese is probably superior to meat. Did not a wise wag chant:

A cook of the College of Caius
Paid the butcher exorbitant faius
And such a deceit
They suffered in meit
They'd better have fed upon chaius.

Rationing need not and should not have such serious effects as was the case in the last war. We have had a quarter of a century's research on nutrition since then, and there is no reason why we should not make use of the results and still feed well.

CANNING IN WAR-TIME

In the past decade, canning operations have been increasingly mechanised. This trend is still continuing and new and ingenious machines are still being devised. That such methods are being fully utilised and that war-time conditions are not appreciably affecting the canning industry are among the impressions gained by a visit to

T. CROSBIE-WALSH, F.I.C.

MACONOCHIE'S

WHATEVER may be the less apparent difficulties and trials (and doubtless there are many) assailing the canner at the present time, due to increased production and the switching over to new and, in some cases, unaccustomed products, the author, as a result of visiting several canning factories during the past few months, failed to note anything very different from the ordinary peace-time routine.

The Black-out

True, the very modernity of modern factory premises, whose splendid lighting and ample window space constitute outstanding features, presents a problem when black-out time arrives, and this has been tackled in different ways. One factory recently visited had its principal department covered entirely with glass roofing, which had occasioned considerable outlay in black paint.

The air-raid shelters, the tin hats of the wardens hanging on the pegs, the provision of special first-aid departments, were other signs of the special job in which the food industry is taking part.

Government supplies occupy a great part of many canners' energies, and this has involved the rearrangement of lay-outs to some extent, in order to provide for the production of special packs.

The executive staffs of the industry are working head down, and the clock is the least important factor in their present scheme of life. There must necessarily be special problems to be negotiated, such as the obtainment at due time of supplies of all descriptions. The temporary breakdown of one solitary link in the chain is sufficient to stop its motion, but fortunately supplies come in regularly enough to avoid serious hold-ups, and, generally speaking, the aspects of the factories are much the same as in the piping times of peace. The old familiar sights and sounds greet the visitor—the *tac, tac* of the double seamers; the constant and monotonous procession of tins along conveyors; the filling of baskets of tins into the hungry maws of the retorts; the neatly dressed and contented-looking girl operatives bending over their different jobs. . . .

All this applies to Maconochie's factory, situated "somewhere in London".

Seventy-five Years Ago

This firm was founded in the year 1865 by J. and A. W. Maconochie, the original works being situated in Lowestoft. With the development of the business it became necessary to expand, and in 1900 the London works were opened, being modernised from time to time, and to-day the firm has two other large factories besides the London one.

Meat and Vegetable Rations

One of Maconochie's activities is the preparation of Army and Navy meat and vegetable rations. These are strictly standardised products of fixed composition, made and packed to specification.

As the name implies, the rations are composed of fresh meat and vegetables, and there are several varieties.

The meat is delivered into the factory in the chilled state, and the first stage of its handling is defrosting, which is necessary before it is boned and trimmed.

Defrosting is effected by hanging in the factory itself, and is usually ready for butchering in the space of a few hours. Boning is done by skilled butchers, who pass the boneless meat to other tables, to be cut up into the small pieces ready for the cans.

Vegetables for the rations are first washed and cleaned, after which they are cut into dices in an appropriate machine. The different ingredients, duly prepared, are ranged at different points along the side of a travelling-belt conveyor, and the empty tins are successively supplied with their exact weights of each.

The filled tins, arriving at the end of the belt, are then passed through the clinching machine, which clinches the lids. They are then conveyed automatically through the exhausters and, emerging from these with their hot contents, are finally closed in the double seamer.

Exhauster Control

Each exhauster is fitted with an automatic regulator, consisting of a simple automatic valve, self-contained and

self-operated. It may be of interest to describe how this regulator works. If a metal container completely filled with oil is hermetically sealed and then heated, the oil will expand with such great force as to split the cylinder. This potential energy is utilised in the regulator. The thermostat forms the oil container; this communicates through a connecting tube with a cylinder containing a piston, the entire system being completely filled with oil. The piston is arranged to operate the valve against the action of an opposing spring. A rise in temperature around the container (thermostat) creates pressure in the oil system, which moves the piston and valve. The spring under the valve gives the reverse movement on a fall in temperature. The tubing, which will withstand pressures in excess of three thousand pounds per square inch (which suggests what enormous power can be utilised in the regulator), is a corrugated bellows tubing to form a packless gland. This exhauster control ensures a standard temperature for the cans emerging for double seaming.

Can Washing

The next step in the cycle of operations to which the tins are subjected is washing.

This is done by can-washing equipment consisting of two separate chambers. In the first chamber the tins are treated with detergent, and, being carried along automatically to the second chamber, they are finally washed with hot water and emerge perfectly clean and free from any traces of fat film.

Falling automatically on the table, they are immediately packed in baskets and conveyed to the retorts. The retorts are fitted with recorders and temperature regulators, which have almost universally become a feature of sterilising operations.

The control of retort temperature (and there is more to it than that, as the entire process, from the time the retort door is shut until it is opened, may now be made automatic and entirely independent of the human factor) has considerably lightened and made more sure the canner's task. This part of the canning process was, in the pre-control days, a very vulnerable one when the harassed retort tender was obliged to skip about turning steam valves up here and turning them up there, anxiously watching steam gauge and thermometer.

Lacquering and Labelling

Sterilisation having been carried out, the next step is the lacquering of the tins. An ingenious automatic lacquering plant has recently been installed for this purpose. It consists in a special battery of automatic spray guns, so arranged that, as the tins are fed into a gravity conveyor, they are picked up, rotated, sprayed and delivered automatically on to a conveyor, which carries them through a drying tunnel of sufficient length to ensure that they are, on their exit, in a condition to be delivered, one by one without handling, straight on to the labelling machine.

The drying tunnel is heated by a steam-heated unit, and incorporated in the scheme is a centrifugal exhaust, with trunking to remove the fumes created by the spray. An item of interest is that a trip is arranged so that if no tins are passing the spray point the spray guns remain inoperative.

Labelling comes next in a machine capable of handling 130 tins per minute. This machine is a modification of the usual labelling machine, as it puts a narrow label, $2\frac{7}{16}$ in. wide, round a can $4\frac{5}{8}$ in. wide. Usually, of course, the label occupies the full width of the tin. In addition, however, to this special function, the machine is adjustable and will handle not only other sizes of cans, but also put on full-width labels if required.

Complete Meals

Maconochie's make a large range of canned and glass-contained products, among which figure "complete meals", which consist of beef or mutton with vegetables.

A special department deals with meat and fish pastes, which Maconochie's market under the "Trident" brand, and flavouring essences are another important activity.

Pickle and Sauce

A very large department is devoted to the manufacture of the well-known "Pan Yan" pickle and "Kep" sauce. Cooking is done in a long line of steam-jacketed pans, and finally finds its way into containers, from which it is drawn into the automatic bottle-filling machine. The bottles of pickle are then conducted by travelling-belt conveyor to the capping machines, and from thence to the automatic labellers.

"Kep"

The story of this new sauce is an interesting one. Last September was not exactly an ideal month for putting a new product on the market, but Maconochie's had made all plans and preparations for months previously, and they were just ready when war broke out.

Undeterred, they went on with production, advertising, everything. Apart from war conditions, it would have hardly appeared to be a promising proposition to put still another thick sauce on the market, already occupied by extensively advertised and old-established brands. However, Maconochie's went ahead, being convinced that there was still room for a sauce having special characteristics of its own—in other words, "something different". A pungent and attractive product, it owes its special characteristics to Indian mangoes and uncommon spices. Maconochie's called it "Kep", which suggests ketchup and rhymes with "pep", and this is specially brought home to the visitor as he passes some of the tables where the ingredients, in their concentrated state, are being prepared!

The sauce and pickle rooms are models of cleanliness and order, and the processes are carried out, as has been said, for the most part automatically.

The bottle used is worthy of special mention, as it tapers from mouth to bottom, so that there literally is no bottle-neck to impede the sauce from container to plate.

So the British canning industry pursues its way, with-

(*Concluded on page* 46)

POTATO STARCH AND FLOUR

It is a matter for wonder, more especially when the ubiquity of the potato as a kitchen staple is considered, that it is not more widely used in manufactured foods. Of all the wealth of vegetable foodstuffs with which man has been so generously endowed, few can contribute so roundly to the diet; few are as comparatively hardy or as productive and adaptable to soil and climate as this tuber.

E. J. THOMAS.

SINCE its introduction into Europe from its native South America, the potato plant has been accorded full recognition of its economic value. Since that time, cultivation of the plant has been undertaken on a large scale in many countries to whose agriculture it has proved a useful addition. Many are the uses, too, to which *Solanum tuberosum* has lent itself. Few, however, are as basically important as that of food.

Potato as a Source of Starch

The general consumption of the potato as the familiar table vegetable needs no elaboration here. Rather are its alternative forms—as starch and flour—of more immediate interest, if only because the belief that the uses, of the former especially, lie in technical fields other than foodstuffs is by no means uncommon. Both potato starch and potato flour, however, have definite applications in food manufacture generally and in baking particularly.

Without attempting to dogmatise with regard to the use of the various terms encountered for these products, the designation "Potato starch" will be used in this article to indicate the 100 per cent. starch product prepared from potatoes by extraction; while "Potato flour" will refer to the comminuted product of the whole potato less its skin and some or most of its moisture. Potato starch will be first considered.

The extraction of starch from potatoes is no modern achievement. Factories for the process were well established in Germany by the end of the sixteenth century, while mention of the potato as a source of edible starch occurs in France even earlier in the same century. Since then the industry has grown largely on the European mainland and has spread to a greater or lesser extent to every potato-producing country in the world.

The process in general is very similar to that in vogue for the extraction of starch from the other commercial starch-bearing tubers such as arrowroot. So much excellent bibliography pertaining to these processes is available that the essentials only can be mentioned here.

Starch Content

A preliminary assay of the starch content of the potatoes determines the price paid the grower for his consignment. Where potatoes are grown for the express purpose of starch production, industrial varieties, inedible because of their high fibre content and poor flesh colour, are grown. The starch in such industrial varieties ranges from 18 to 23 per cent.; very occasionally as high as 25 per cent. In districts where starch factories operate solely as an outlet for the surplus of edible potatoes when bumper crop yields glut the vegetable market, production is seldom economic. The starch content of the edible potato amounts only to between 14 and 17 per cent., of which 1 per cent. or so is usually unrecoverable. It is from such factories, therefore, practically compelled to curtail their process in order to reduce manufacturing costs, that the inferior grades of potato starch usually come.

Preliminary Treatment

To continue with the process, having been culled for rots and partial rots, the potatoes are then submitted to one or two washings for the removal of adherent dirt. From the washing troughs they are conveyed to the pulping machines that first grate the tuber very finely to rupture the cell structure as completely as possible, and then, by violent agitation and the addition of large volumes of water, loosen and set free the starch granules. The resulting diluted pulp is run over a series of screens of such a size as to permit the starch to pass whilst retaining the pulp. A second and even a third dilution with water, followed by agitation and screening, is accorded the pulp for the more complete extraction of the starch.

The mixture of starch and water which has passed through the screens, known as "milk of starch", is run into a settling vat where, after the starch has settled at the bottom, the supernatant liquid containing soluble matter and slimes, set free with the starch in the grating process, is run off. Again, more water is run into the vat, and by means of mechanical stirrers the starch is given another washing. This, the second wash water, is in its turn replaced by more clean water after the starch has settled and the washing process again repeated. Each of the washings may occupy some hours, and no part of the manufacture of starch is as important to the production of a quality article as these operations.

After the removal of the last of the washing water, the mass of moist starch remaining at the bottom of the settling tank has the top surface scraped off to remove those small amounts of foreign matter which, in settling only a little less slowly than the starch itself, are not

always eliminated when the last water is decanted. The scrapings are held for re-washing with later batches. The starch paste is now ready for drying. Modern plants employ the centrifuge and vacuum-dry their product in order to avoid the use of heat which may cause partial gelatinisation of the starch. Drying continues until the moisture content is reduced to 15 or 20 per cent., when the starch is ready for milling and dressing.

Standards of Quality

For use in foodstuffs potato starch should conform to certain standards. It should be free from black specks—at least as reasonably so as possible—and quite free from particles of grit or sand, the presence of which is sure indication of unthorough preliminary washing. It should be free from any dingy yellow colour, although, on the contrary, brilliance is unnecessary and infers the presence of added colour. Anything in the nature of a disagreeable odour to the product, be it mustiness, sourness or smell of putrescence, would, of course, bar its use. No exception need, however, be taken to the smell, so often accompanying good quality starch, and reminiscent of the odour of freshly cut potatoes, but even this should be only fleetingly discernible. In the laboratory the starch should yield none or very little trace of sulphurous acid or other preservative. Such usually enters the process of manufacture either as a bleach or as a preservative when, for comparative lengthy periods, the starch is in contact with water. But the need for a preservative ceases to exist when the starch is dry and its removal should be complete. Last of all, tests for solubles are enlightening as to the quality of the product where a high solubles ratio is certain indication that it has not been given an adequate number of washings.

Comparison with Other Starches

In fairness to the other starches in common use in foods it can hardly be claimed that potato starch has any decided superiority over them. However, since its gelatinisation temperatures range[1] from 135° to 142° F., and its consistency when cooked, despite its unusual early swelling propensities, is approximately the same as that of wheat, tapioca and maize starches, there seems no reason why, where its use is economic, it should not replace some of them as a constituent in that large variety of blended starch products such as custard, blancmange and pie-filler powders, in which the character of its gel might provide an interesting variation of the more usual rice, tapioca or sago-containing mixes that compete with one another in this country. Nor is this entirely supposition; in both the United States and Canada potato starch is commonly used along these lines.

Again, in prepared cake mixtures, especially those of the sponge and waffle types, a far superior product is obtained by replacing, up to 40 per cent., the usual wheat flour with potato starch. The effect of the consequent reduction of gluten, however, must be met by an increase—although not in the same proportion—in the egg content of the mixture. A better known use for the starch is in the manufacture of soup and gravy powders. Consisting as they do of mixtures essentially of starches, meat or yeast extracts, caramel, salt and seasoning, potato starch has qualities of greater moisture tolerance and texture that make its employment as the predominant starch ingredient practically essential.

Potato Flour

Potato flour differs from potato starch in many ways. In the first place it represents not merely its starch content, but the whole potato, and is obtainable cooked or raw. The raw product is obtained by washing, peeling and de-eyeing the potato, reducing it to a mash by mechanical means and evaporating off the moisture to leave a fine, dry flour containing the raw starch, sugars, proteins and minerals of the tuber. A newer process for the production of the cooked form[2] involves the washing, peeling and cooking of potatoes to a soupy pulp which is then spray dried. The net result in this case is, of course, the same as that achieved by the other process except that the flour is thoroughly pre-cooked.

The composition of potato flour varies within somewhat narrow limits with the variety used in its manufacture; influences contributed by soil conditions during the growth of the potato and conditions of storage and the interval between harvesting and processing. Almost any flour, however, will approximate the following analysis:

Water, 7·0 to 8·0 per cent.
Protein, 8·0 to 9·0 per cent.
Fat, 0·2 to 0·5 per cent.
Carbohydrates (inclusive of starch and sugars), 80·0 to 82·0 per cent.
Ash, 2·0 to 2·5 per cent.

The digestibility of potatoes has been fully established. According to Whalley,[3] Archbold states that *in all forms* potatoes leave the stomach within one or two hours and are absorbed by the small intestine in three hours. The same source[4] mentions the findings of such investigators as Hinhede, Thomas and others, who report favourably on the nutritive value of potato protein, although differing opinions are voiced by other writers.

Uses of Potato Flour

The use of potato flour or its former counterpart, the whole mashed potato, in baking extends back over a number of years. Even twenty years ago Moore and Partridge[5] record the use in breadmaking of boiled potatoes to the extent of one per cent. to render the bread white; while for those engaged in the trade at the time, memory may recall, under the Defence of the Realm Act, the Bread (Use of Potatoes) Order of 1918 which the same authors mention. This Order permits the use in the manufacture of bread of "such quantities of potatoes as the maker may think fit"! Although admittedly an emergency measure, designed for those

(*Concluded on page* 38)

THE STORAGE AND PROCESSING OF EGGS

Egg production, importation and exportation, handling, storage, preservation and drying are all parts of a specialised industry. In this article the author describes some of main operations concerned.

HAROLD SILMAN, B.Sc., A.I.C.

EGGS and egg products form a vital ingredient of a great many food products, covering such diverse materials as mayonnaises, confectionery, and food drinks.

The egg of the domestic hen supplies the bulk of the world market requirements, although other eggs such as those of the duck, goose, turkey, and sea-gull are esteemed. The natural fecundity of the hen, however, has made it the prime producer of eggs for human consumption.

A Specialised Industry

Egg production, importation and exportation, storage and handling has become a specialised industry, and the grading and consequent reliability of eggs is constantly improving. This is important, particularly for the food manufacturer who is an egg user, since one or two eggs which are not in the best of condition may result in the spoilage of a large batch of finished product.

There are one or two common misapprehensions regarding eggs which are, unfortunately, not confined to the retail customer. One of these is the question of the colour of the shell. Actually the colour of the shell is of no importance either as a guide to quality or freshness. Another is related to the shell texture. The egg, as freshly laid, is covered with a thin protein film. This film gives the egg a dull matt colour, which is removed in time by handling, prolonged storage, etc. The egg then acquires a glossy shell, which, although not necessarily indicating that it is not in good condition, nevertheless suggests that the egg is not a newly laid one.

The Structure of Egg

In its structure the egg consists of a germ cell surrounded with a yolk of varying colour; the yolk colour depends to a great extent on the diet of the hen. The yolk is in the form of a relatively concentrated emulsion, containing many valuable nutritive constituents, being the sole source of food of the developing chick. Vitamins A and D (fat soluble) are present in abundance and vitamins B, C, and G are also present in smaller amount. Egg yolk contains about 50 per cent. of its weight in water, the balance being made up of proteins and fats, the former constituting some 15 per cent. of the total weight and the latter about 30 per cent. Small quantities of various salts are also present to the extent of about 1 per cent., including organic phosphorus in the form of lecithin. The yolk itself is in layers of dark yolk with thin intermediate layers of lighter-coloured emulsion.

Surrounding the yolk is the delicate vitelline membrane, to the ends of which are attached the chalazæ. The latter are two fine cords reaching out along the longitudinal axis of the egg, about which the yolk can rotate within the shell. This is necessary in order that the embryo chick may be able to locate itself on the upper side of the yolk during incubation to obtain the greatest advantage from the heat of the mother hen.

Around the yolk is the egg white, which consists of a mixture of albumens and water. The white is also striated like the yolk. In direct contact with the yolk is a thick albuminous layer surrounded by another layer of somewhat thinner albumen. Around this is again an intermediate layer of thick albumen, with another watery albuminous layer on the outside. Between the latter layer and the outer shell are two further membranes, the *membrana testacea*. The outer of these is quite tough and relatively thick, the inner egg membrane being very much thinner.

The egg-shell itself is composed largely of calcium carbonate, and is of a fibroid porous construction. Air can enter through the shell quite readily to enable the developing chick to breathe, whilst similarly water vapour or gases may escape through the shell. The shell itself is usually about ·015 in. in thickness. Modern methods of intensive egg cultivation, however, tend to speed up the development of the egg within the hen's body to such a degree that in many cases the shell is considerably thinner and weaker. This has the disadvantage of making the egg more fragile for transport, and also to a certain extent rendering the ingress of bacteria more easy.

The shell itself is readily permeable to bacterial infection, particularly when the protective outer protein layer which is present on the newly laid egg has been removed. For this reason the washing of eggs, although improving their appearance and increasing their market value, may tend to decrease their keeping qualities by removing this layer of protein.

A newly laid egg, while it is at the body temperature of the hen, is completely filled, but on cooling a contraction of the contents takes place; air enters through the shell and a small air-space is formed between the egg membrane and the shell. Further evaporation of water causes an increase in the size of this air-space, the size

of which may thus be used as a guide as to the age of an egg.

Egg Testing

Eggs are examined prior to marketing by the so-called "candling" test. The egg is held broad end uppermost before a brightly lit opening in a lantern in a darkened room. In this way the size of the air-cell can be readily seen, and it is also possible to judge, from the amount of light which passes through the egg, the density of the albumen, the colour of the yolk, the extent to which the latter moves, and so on. Easy motility of the yolk when the egg is rotated shows that the white is watery and has lost its firmness. Such eggs are generally of poor quality. The outline of the yolk should be only faintly visible if the white is in good condition. In eggs of the very best quality, the air-cell should not exceed $\frac{1}{8}$ in. in diameter and be of a uniform shape. Eggs with air-cells up to $\frac{3}{8}$ in. in diameter may be quite fit for consumption, however.

Candling also enables the extent to which embryonic development has proceeded to be determined. It is by no means uncommon for fertilised eggs to reach the market; should fertilisation take place, rapid development of the embryo occurs at the body temperature of the hen in the day or so which elapses between the fertilisation and the laying of the egg.

Blood spots are also occasionally seen in eggs, due often to some unusual condition of the oviduct of the hen. These can be detected by candling and the eggs are rejected for domestic consumption, although they are generally quite safe, and are marketed for manufacturing purposes.

Preservation

The fresh egg, which has not been preserved or stored under artificial conditions, is a rarity to-day in the commercial food industry. Eggs are preserved for two main reasons. Firstly, there is the question of transport from regions and countries where there is a high productivity (such as China) to the world's markets. In such cases some form of preservation is essential in order that transport of large quantities of eggs should be practicable. Secondly, as the hen is most productive in the spring, it becomes a paying proposition to store eggs for the winter. The advantages of this procedure are that, by the withdrawal of spring eggs from the market for storage purposes, prices are prevented from falling to an uneconomic level, whilst winter prices are similarly kept from rising inordinately.

Cold Storage

The storage of eggs is now largely carried out in refrigerated warehouses; many ships engaged in egg transport have refrigerated holds. Conditions of storage must be carefully regulated, since eggs are prone to pick up odours. For this reason adequate ventilation must be ensured by careful stacking of egg cases. In America ozonising equipment has been installed in some warehouses, a small concentration of ozone in the atmosphere being said to be conducive to eliminating atmospheric odours and perhaps helping to inhibit the development of micro-organisms. While ozone may be of value from the first point of view, it is very doubtful whether it would be of great use as an active disinfectant under these conditions.

The temperature under which cold-storage eggs must be held is important, and depends to a degree on the type of egg stored. The more watery the albumen the higher should be the temperature of storage, which is generally from 31° to 34° F. Lower temperatures may be used where the egg white is firmer, as is generally the case with spring-laid eggs. In this connection it is of interest to note that early summer eggs keep better in cold storage than later ones. This is possibly connected in some way with the lower water content of the albumen in eggs at this time of the year.

Eggs which are stained or have been in a dirty condition and have had to be washed are usually stored at the lower temperatures, but good clean eggs will keep for as long as is normally required at temperatures slightly above freezing point.

Humidity Control

Another factor which requires careful control in egg storage is the relative humidity of the atmosphere. If the humidity is too low, moisture will evaporate from the interior of the egg with a resulting increase in the air space within the shell and progressive deterioration. On the other hand, higher humidities encourage the growth of moulds on the shells, which is not only unsightly and causes staining, but may enable the mould to penetrate into the egg through pores in the shell. Dampness also quickly destroys the protective protein layer which is normally present on the shell.

Changes During Storage

Eggs cannot be kept in cold storage indefinitely, nine months to one year being about the limit. The first feature which is lost is the very delicate flavour possessed by the newly laid egg. Subsequently, other changes take place. The fat within the yolk may tend to break down with the development of rancid or musty off-odours, due to the formation of fatty acids. The proteins may also show signs of decomposition in which case ammoniacal odours come into evidence.

Apart from these changes, two other defects become noticeable in cold-stored eggs. Firstly, there is a tendency for the yolk to increase in size. This is because the vitelline membrane surrounding the yolk is a semi-permeable one and allows water to enter into the yolk from the white. This effect cannot be controlled by any known method, so that storage eggs need to be handled somewhat carefully to avoid yolk breakage. The whites of cold-stored eggs may also lose viscosity, probably due to autolytic breakdown of the proteins, which affects their whipping qualities.

Gas Storage

In Denmark, where the cold storage of eggs has been highly developed, a process which has met with some

success involves the evacuation of the eggs with subsequent cold storage in an atmosphere of carbon dioxide and nitrogen. It is claimed that in this way the storage life is increased and the development of off-odours inhibited.

The reasons for this procedure are based on the fact that eggs normally commence to lose carbon dioxide rapidly from the moment they are laid, particularly at higher temperatures. For this reason eggs should be cooled as soon as possible after laying. The loss is primarily from the yolk itself, through the white, and then to the atmosphere. The *p*H of the newly laid egg yolk is about 7·6, a figure which increases rapidly until it may rise as high as 9·7. Storage in the nitrogen-carbon dioxide atmosphere maintains the gas equilibrium within the egg with favourable results.

Egg Cleaning

To improve the appearance of eggs, they are often washed, which affects to some extent their keeping qualities. Washed eggs may be detected by placing a drop of distilled water on the shell of the egg, transferring the drop to a microscope slide and adding a little of a weak solution of silver nitrate. If any chloride is present, as is invariably the case when the test is carried out on an unwashed egg, a white precipitate of silver chloride will form immediately. The chloride is derived from the salts contained in the protein film on the shell. Sometimes eggs are subjected to a fine sandblast to remove dried-on dirt which is not easily removable by washing. The sandblast is directed on to the eggs, which are placed in a small chamber on a revolving rubber belt. In this way the whole surface can be cleaned very quickly. In some cases eggs are dipped in mineral oils to seal the pores in their shells. This helps to prevent loss of carbon dioxide from the egg with consequent increase in the air-space, and also to some extent prevents the ingress of micro-organisms.

Frozen Eggs

There is a considerable market for canned frozen eggs, and egg-freezing and canning is an extensive industry, especially in China and in the U.S.A. The advantages of being able to transport egg meats in cans are obvious from the space and breakage points of view alone; in addition, it is perhaps not so well known that the inedible portions of the egg constitute some 15 per cent. of its total weight. Another advantage of freezing is that the consumer can purchase whites or yolks as required, and moreover, a market is provided for eggs which are too small or thin-shelled to be saleable.

In an egg-freezing establishment the eggs are first candled, and then broken on a blunt knife-edge into a small cup. The operator smells each egg before allowing it to enter the bulk container. If the yolks and whites are to be separated, this is done by the use of a separating device consisting of a concave disc placed just above the cup, where the yolk is caught; yolk and white are then dropped into separate small cups, whence they are transferred to the bulk container if up to standard. This individual testing is an essential precaution to avoid spoilage of a large bulk of material. If a faulty egg should be detected the equipment is sterilised and the hands of the operator are washed. The whole of the factory must be kept scrupulously clean and sterile to prevent bacterial contamination, which might have serious consequences for the factory output.

Thawing Out

Frozen eggs should be used soon after thawing out. It is preferable to thaw out slowly, to prevent undue thickening of the yolks. During freezing, whole eggs and yolks tend to thicken, whilst the whites become rather more fluid. It has been found that if the storage temperature is allowed to fall below 24·5° F. this tendency to thickening on thawing out is very much enhanced. Careful temperature regulation is nowadays the rule and excessive thickening of the product should not occur.

For baking purposes the texture and viscosity of the product are of great importance. There is therefore a certain market for frozen eggs mixed with sugar. The latter ingredient not only helps to preserve the eggs, but results in a product particularly suitable for baking and confectionery purposes, where the presence of sugar is no disadvantage.

It has been shown that the vitamin A concentration of eggs cold stored for nine years underwent very little change during this period, and the food value of such eggs is probably little different from that of fresh eggs. The use of frozen eggs will undoubtedly increase in the near future.

Dried Eggs

Egg desiccation is another much utilised method of egg preservation, and the advantage here is that the product need not be kept under refrigerated conditions, although a cool storage place is desirable. Dried whole eggs, white or yolks, are available. The yolks are in greatest demand for the baking trade, whilst the whites are in extensive use in the manufacture of whipped delicacies, such as marshmallows, meringues, etc.

Technique of Drying

The technical problems involved in egg-drying are fundamentally similar to those encountered in the manufacture of dried milk, but a number of special points must be attended to. In order that the dried whole eggs or yolks should keep, it is essential that their fat content (which averages some 30 per cent. of yolk bulk and about 10 per cent. of the total egg meal) should be removed as far as is practicable, since this constituent is highly decomposable even when dried. In the treatment of whole eggs, they are first broken under conditions similar to those already described for frozen eggs. After homogenisation the mixture is evaporated *in vacuo* at a temperature of about 65° F. to prevent coagulation of the albumen: the water content of the material is thereby reduced from its original value of about 74 per cent. down to 10 or 12 per cent. Dextrin aids in the prevention of albumen coagulation, and is

sometimes added to enable the evaporation to be carried out more rapidly at a higher temperature.

Fat Extraction

The concentrate thus obtained is then extracted twice with either benzene, or, more generally, petroleum ether for an hour or two, the solvent being removed by vacuum distillation at a low temperature. The oil content of the product should then not exceed 1 per cent., but in the presence of dextrin this figure can be even higher, since the dextrin serves to adsorb the fats and inhibits deterioration. A percentage of dextrin is a valuable constituent from the keeping-power point of view. The cheaper products, however, often contain larger quantities of dextrin in an endeavour to improve the keeping qualities of yolks from which the oil has been inadequately extracted. Dextrin also, to a certain extent, serves as an adulterant. Drying may be carried out either by the spray or the drum process.

Spray Drying

In the former method, which is used especially for yolks, the liquid is sprayed at high pressure into a chamber maintained at a temperature of about 160° F. A constant stream of dry air passes through the chamber, and the fine powder, which is prevented from being blown out by a system of baffles, is collected and packed in air-tight drums.

Roller Drying

Roller drying is carried out to some extent on whole eggs. The egg liquid is run on to heated aluminium drums, or belts passing through heated chambers, and the layer of dried material is scraped off by a knife. Whites are treated somewhat differently, being usually allowed to undergo a short period of fermentation, during which time enzymic hydrolysis takes place, with the production of a degree of acidity. This is neutralised, the product is allowed to settle or is centrifugally filtered, and drying is then carried out as above.

The drying temperature of albumen, however, must not be allowed to exceed the coagulation temperature and is therefore regulated at about 120° F. Should coagulation occur to any extent the resulting flakes would lose their solubility and whipping properties. The equipment used is similar to that described above.

On an average each 5 lb. of whole eggs would yield about 1·4 lb. of dried product, whilst corresponding quantities of yolks and whites would yield 2·2 lb. and 0·7 lb. of dried product respectively.

Canadian Wheat and Selenium

It has come to be known in the last few years that the soil of an extensive area of the ranching region of Wyoming and Arizona and of the wheat-growing State of North Dakota contains appreciable amounts of selenium. Selenium is one of the less common elements. Chemically, it resembles sulphur, but while sulphur is not poisonous in the forms in which it normally exists in the soil and in foodstuffs, selenium is at least mildly toxic to many plants and animals. Some weeds peculiar to the seleniferous regions of North America accumulate quite large amounts of selenium without suffering any harm. These plants actually need selenium, and are thus botanical freaks. It is said that their presence (and consequently the existence of a seleniferous area) can be detected at a distance by the garlicky odour they give off while alive.

As chemical elements are not respecters of political borders, it occurred to one of the American experts on seleniferous soils that it would be worth while investigating the soils and crops on the British side of the border. He has made the rather astonishing observation that a huge seleniferous area exists in Canada; it extends through several wheat-growing provinces. The trip was quite rapid, but, aided by his experience in finding the selenium-indicating weeds, and by relatively few analyses, the tourist was enabled to put forward conclusive evidence. Two samples of seedling wheat-plants contained 40 and 80 parts of selenium per million; other plants contained 4 parts-per thousand.

No evidence has yet been offered regarding the prevalence of selenium in Canadian grain, but it may be supposed that the Dominion analysts are busy on the matter. Cases of selenium poisoning have been reported from northern States of the Union, and a group of people living in a seleniferous State were found to be excreting relatively large amounts of selenium in their urine. A condition of farm animals in Canada, which was not understood, and to which the name "frozen feet" was given (though it was not due to cold), is now strongly suspected of being caused by ingestion of excessive amounts of selenium in fodder grown on seleniferous soil. We await with interest the publication of information regarding the selenium content of human foodstuffs. Meanwhile we would point out to millers that if any oniony odour is noticed during the processing of North American wheat, an analysis for selenium should be instituted.

Potato Starch and Flour

(*Continued from page* 34)

days of stress in this country, the practice need not be regarded purely as food substitution. Contemporaneous practice, at least in America, calls for from 10 to 20 per cent. of potato flour, with or without the addition of corn meal to reduce, by permitting the addition of greater amounts of water and completely hydrating the gluten, excess elasticity or "dough tightness". As an improver of crumb texture and colour, further claims for the use of potato flour embrace anti-staling properties and flavour which are valuable in the baking of brown—and especially rye—breads.

It is a matter for wonder, more especially when the ubiquity of the potato as a kitchen staple is considered, that it is not more widely used in manufactured foods. Of all the wealth of vegetable foodstuffs with which man has been so generously endowed, few can contribute so roundly to the diet; few are as comparatively hardy or as productive and adaptable to soil and climate as this tuber; yet it apparently requires a national food emergency before its inherent possibilities are fully made use of.

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THERMOPHILIC ORGANISMS IN STARCH AND SUGAR

PART 2

The authors describe the technique employed in the examination of sugar and starch, review existing standards for thermophiles and, since the methods of production of starch and sugar are different, describe comparative studies of the two substances.

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Thermophilic Contamination in the Sugar Factory (*Continued*)

AN attempt was made to illustrate and account for the changes in thermophilic contamination which had direct bearing on the finished sugar. Thermophilic removal by standard syrup filtration was better than 95 per cent. efficient over the greater portion of press operation. Anaerobes increased immediately following filtration, yet attempts to demonstrate accumulation in the receiver were not conclusive. Results indicated flat-sour growth within the pan storage tanks on the liquor or wall surfaces. Of the succeeding operations, changes during the boiling were not investigated. Further data, however, showed one instance of wash water contamination by anaerobes which was subsequently traced to growth within the fifth-body evaporator steam chest. Tests of the effect of different quantities of centrifuge wash water showed no change up to 18 quarts. At 21 quarts, however, the contamination was definitely reduced.

For what was believed to be the first time, a primary source of anaerobic contamination within a sugar factory was located. In addition to those in the fifth-body water, large numbers of anaerobes were shown to be developing in the tail-pipe vacuum system and constantly entering with the battery supply water. Cameron and Williams (1928), examining one factory, found evidence of high contamination in the vacuum evaporator.

Though these investigations were made in only two factories, the results are a definite contribution to the sugar industry. Starch probably has been studied in this same connection, yet no publications have been found which describe the source of infections. Methods of removing the infection must have been developed, for starch manufacturers are now marketing a product conforming to the standards of the National Canners Association.

Methods of Analysis of Sugar

Bigelow (1931) stated that canners were, by that time, interested in purchasing sugars which were bacteriologically safe for canning. Refiners had been conducting investigations and believed they could furnish sugars within standards if and when such standards were established. The National Canners Association established tentative standards by which they would judge quality of canning sugars. Methods of analysis were published, which are still used. The early work on flat-sour organisms used a dextrose-yeast-water agar medium, but comparative studies have shown dextrose tryptone agar to be equally suited, and, because of its ease of preparation, preferable. Cameron (1936) published the latest methods for examining sugars. The methods are as follows:

Sampling

One-half-pound samples should be taken from each of five bags or barrels of the shipment or of the lot in question. These samples should be sent to the laboratory in clean sealed cans or other appropriate containers.

Preparation of the Sample

Place 20 grams of sugar in a sterile 150 c.c. Erlenmeyer flask marked to indicate a volume of 100 c.c. Add sterile water to the 100 c.c. mark. Bring rapidly to boiling and boil for 5 minutes. Replace any evaporation.

A modification of this procedure has been used which seems to be more accurate without sacrificing the ease of preparation. Instead of making the solution up to 100 c.c. volume, it was made up to 100 grams with sterile water, simplifying replacement of evaporation.

Detection of Flat-Sour Spores

Pipette 2 c.c. of the boiled sugar solution into each of five Petri dishes. Cover and mix with dextrose tryptone agar. Incubate the plates at 55° C. (131° F.) for 36 to 48 hours. The combined counts of the five plates represent the number of spores per 2 grams sugar. Results are reported as per 10 grams, so the count is multiplied by five.

Flat-sour colonies are characteristic. The colony is round, measures from 2 to 5 mm. in diameter, has a typical opaque central spot, and by reason of acid production in the presence of the indicator is usually surrounded by a yellow halo in a purple field. Where there is doubt as to the identity of the sub-surface colony, a

decision can usually be made by observing the nature of the surface colonies. Where the surface colonies evidence reasonable purity of flora, it is safe to assume that the sub-surface colonies have been formed by similar bacterial groups.

Detection of Thermophilic Anaerobes not Producing H_2S

Divide 20 c.c. of the sugar solution approximately equally among six liver broth tubes and stratify the liquid medium with plain agar. Incubate at 55° C. (131° F.) for 72 hours.

Thermophilic anaerobes are evidenced through splitting of agar due to gas production and the presence of acid. The method is considered suitable as a qualitative test, quantitatively only as a means for estimating relative contamination. Report the number of positive tubes.

Detection of Sulphide Spoilage Spores

Divide 20 c.c. of the sugar solution approximately equally among six tubes of "sulphite" agar. Incubate at 55° C. (131° F.) for 72 hours.

Sulphide spoilage organisms are detected through the formation of characteristic blackened spherical areas. Due to the solubility of hydrogen sulphide and its fixation by the iron nail no gas is noted. Certain of the thermophilic anaerobes (not producing H_2S) give large amounts of hydrogen which splits the agar and reduces the sulphate, thereby causing the whole tube to become blackened. The condition is readily distinguishable. The blackened areas may be counted to obtain quantitative results—multiply the number of colonies by 2·5 to report results per 10 grams sugar.

Reporting Results

Flat-sour organisms. Count the colonies on all five Petri dishes, multiply by 5 to report results per 10 grams sugar.

Thermophilic anaerobes. Report as number of tubes positive and negative.

Sulphide spoilage spores. Count colonies per six tubes, multiply by 2·5 to give results per 10 grams sugar.

Methods for Examination of Starch

By 1937 sugar had been carefully studied. Yet one important ingredient added to canned foods, especially to cream-style corn, had received little attention. Cameron (1937) reported that spoilage bacteria had been found in starch. Clark and Tanner (1937) studied analytical methods for examining starch and developed modifications of the National Canners Association methods for sugar which would adapt these analyses to starch. The analysis of 20 samples of starch confirmed the work by Owen and Mobley (1932), who found an average of 131 flat-sour spores, 50 per cent. of the portions from each sample containing thermophilic anaerobes and 33 per cent. sulphide spoilage organisms. Tanner and Clark found an average of 193 flat-sour spores, 50 per cent. of the portions positive for thermophilic anaerobes and only 5·5 per cent. samples showing sulphide spoilage organisms. An improved technique indicated a lower average number of spoilage organisms.

The thickening of starch when heated makes the unmodified use of sugar methods impractical. Clark and Tanner (1937) have proposed a method. This method was compared to four collected by Yesair, one of which is used by the National Canners Association. Since the method of Clark and Tanner was used in this study, it will be reviewed.

Preparation of Sample: 10 grams of starch are weighed into a sterile flask. Enough water is added to make up to 100 grams. This mixture is thoroughly stirred and pipetted into the media for detecting the various groups of organisms.

Detection of Flat-Sour Spores: 20 c.c. of the starch suspension are pipetted into 100 c.c. melted dextrose brom-cresol-purple agar or dextrose tryptone brom-cresol-purple agar, the mixture being stirred as the starch suspension is added. This agar starch mixture is then heated with frequent shaking until the starch flows, and is then placed in the Arnold steriliser for 30 minutes with occasional shaking. Place equally among six Petri dishes. Incubate at 55° C. (131° F.) for 36 to 48 hours.

Thermophilic Anaerobes: 20 c.c. of starch suspension are distributed equally among six tubes of liver infusion broth which have been previously heated to 100° C. (212° F.). After reheating and agitating to distribute the starch thoroughly and prevent excess foaming, they are placed in the Arnold steriliser for 30 minutes, cooled and stratified with plain agar. They are then incubated at 55° C. (131° F.) for 5 days.

Sulphide Spoilage Spores: 20 c.c. of starch suspension are distributed equally between six tubes of melted "sulphite" agar. The medium and starch are shaken thoroughly to distribute the starch and then heated in the Arnold steriliser for 30 minutes. After heating, thoroughly agitate, allow to harden and incubate for 5 days at 55° C. (131° F.).

Media for Examination of Sugar and Starch

Flat-Sour Organisms—

10 grams tryptone
15 grams agar
5 grams dextrose
1,000 c.c. water.

Reaction is adjusted to *p*H 7·0.
Agar is bottled in 100 c.c. portions.
Sterilise for 30 minutes at 15 pounds (121° C.).
Add brom-cresol-purple just before pouring plates.

Thermophilic Anaerobes—

500 grams fresh liver or 135 grams dehydrated liver are boiled in 1,000 c.c. water for 1 hour.
Liver infusion filtered through cheese cloth, and made up to a liver.
Add 10 grams peptone
1 gram K_2HPO_4.
Adjust reaction to *p*H 7·0.
Place small amounts of the ground liver in test tubes and add 5 to 6 c.c. liver broth.
Sterilise in autoclave at 15 pounds for 30 minutes.

Sulphide Spoilage Organisms—

100 grams yeast and 1,000 c.c. water autoclaved for 5 hours at 15 pounds.
Allow the mixture to settle for several days, decant the liquid layer.
Add 15 grams agar
1 gram Na_2SO_3
30 grams sucrose.
Tube with a freshly pickled nail.
Sterilise at 15 pounds for 30 minutes.

New Media described by Cameron

Owing to the inconvenience of preparation of yeast water and indifferent results obtained by substituting yeast extract, Cameron (1938) has proposed a new medium for detecting "sulphide" spoilage organisms in sugar. This medium consists of water—1 litre, tryptone—10 grams, Na_2SO_3—1 gram, and agar—20 grams. At the time of tubing a clean iron strip or nail is placed in the tube. It was found by comparative tests that this new medium was more satisfactory than the one previously proposed.

Standards for Sugar and Starch

Bigelow (1931) included the National Canners Association standards for sugar in the report of analytical methods for its examination. Owen and Mobley (1935) criticised these standards because they included only thermophiles. Since the microbial flora of refined cane sugars includes mesophilic and thermophilic spore-forming bacteria, yeasts and moulds, they believed the presence of any of these groups in large numbers was objectionable. Sugars are used in many ways, as in soft drinks, where a heavy micro-organism contamination is undesirable. They proposed the following in addition to the National Canners Association standards for thermophiles.

1. The percentage of mould infection in any lot of sugar should not exceed 20.
2. Number of mould spores should never exceed 10.
3. Not more than 20 per cent. should contain viable yeast cells.
4. Maximum of 50 yeast cells per gram.
5. Maximum number of bacteria other than thermophiles (already controlled) should not be over 50 and the maximum total count should be 100.

Owen and Mobley's standards have not received wide acceptance, especially by the National Canners Association, which still use the following standards for thermophilic bacteria:

Total Thermophilic Spore Count: For the 5 samples examined there shall be a maximum of not more than 150 spores and an average of not more than 125 spores per 10 grams of sugar or starch.

Flat-Sour Spores: For the 5 samples examined there shall be a maximum of not more than 75 spores and an average of not more than 50 spores per 10 grams of starch or sugar.

Thermophilic Anaerobes: These shall be present in not more than 3 (60 per cent.) of the 5 samples, and in any one sample there shall not be more than 4 (65 per cent.) positive tubes.

Sulphide Spoilage Spores: These shall be present in not more than 2 (40 per cent.) of the 5 samples and in any one sample to the extent of not more than 5 colonies per 10 grams. This is equivalent to 2 colonies in the 6 tubes.

Comparison of Commercial Sugars in Recent Years

In examining the summaries of the National Canners Association laboratories for the sugars analysed during each packing season, a trend towards improvement is noticeable.

TABLE C.

AVERAGE SPOILAGE CONTAMINATION IN SUGARS IN 1928 AND 1929

	Average Contamination Per 10 Grams.		*Approximate Per Cent. Positive Tubes.*	
Year.	*Flat-sour.*	*Sulphide Spoilage.*	*Thermophilic.*	*Anaerobic.*
1928	133	6·4	20	—
1929	114	3·3	25	—

The following results on starch and sugar samples have been taken from the Annual Report of National Canners Association for 1938:

TABLE D.

SUGAR.					
Year	1934	1935	1936	1937	1938
Total samples ...	204	814	564	599	725
Number within standard ...	156	673	525	567	628
Per cent. within standard ...	76·4	82·7	93·1	94·6	86·6
STARCH.					
Year	1934	1935	1936	1937	1938
Total samples ...	165	63	259	121	138
Number within standard ...	107	58	183	99	133
Per cent. within standard ...	64·9	92·1	70·7	81·8	96·4

Beet Sugar

One interesting speculation arises concerning beet sugar. Each year beet sugar was consistently higher in quality. Whether this fact is significant is a matter of personal opinion. From the 1937 report by Yesair and Reed, the National Canners Association position is ascertained. "As stated in the report for 1936, this analysis should not be taken to indicate that beet sugar is superior in bacterial quality because our coverage of the beet-sugar group is not as complete as that for the cane-sugar group, and the general experience shows no inherent advantage in one type of sugar over the other."

Effect of Sugar Storage

Work on the thermophilic food spoilage bacteria in sugar has revealed an apparent gradual decrease in the numbers of spores during storage. Hall (1938), in periodic examinations made on stored white beet sugar, observed a decrease in numbers of spores of these organ-

isms. *Bacillus stearothermophilus* Donk was the predominating type, and previous to storage was found in numbers exceeding the standards in some samples. Storage for several months often resulted in mortality of sufficient spores to raise the quality to that of canning grade.

Hall (1939) later reported the rate of reduction of flat-sour spores in stored sugar. Beet sugar containing thermophilic food spoilage organisms was stored in paper, burlap, towelling and glass containers. Samples stored for from 8 to 20 months showed a decrease in 35 (87·5 per cent.) of 40 samples, varying from 11·1 to 92·8 per cent. of the thermophilic flat-sour spores in sugar stored in paper bags. In glass containers spores of this organism were reduced from 6·8 to 100 per cent. Reduction of spores in the samples stored for 20 months did not appear correspondingly greater than in samples stored 8 months. No relationship could be demonstrated between impurities in the sugar and the reduction of numbers of spores.

Results similar to those reported by Hall were obtained by the authors in the early work here reported. Ten samples of sugar used in previous experiments were examined after 6 months' storage in sealed tin cans. The original counts on these samples were all within the limit set by the National Canners Association, ranging from 50 to 75 thermophilic flat-sour spores per 10 grams of sugar. The average for the 10 samples was 70. After storage no thermophilic flat-sour organisms could be isolated from 3 of the 10 samples. Counts ranged from 0 to 30 with an average of 15, or a reduction of from 40 to 100 per cent., the average reduction being 75 per cent. Thus the bacteriological quality of this sugar was improved by storage. An increase in the number of spores never was observed. No attempt was made to determine the factors which cause the decrease. From such a limited number of samples definite conclusions cannot be drawn, but the work substantiates observation of others. Although an extensive examination of starch has not been made, observations in the laboratory would indicate that spoilage organisms also decrease in starch during storage.

Comparative Studies of Sugar and Starch

Since the methods of production of starch and sugar are different, a comparative study of the thermophilic flat-sour spoilage organism in both products was made. Samples of starch and sugar were analysed according to the technique for these materials. From the plates, colonies were picked for study. The majority of the colonies from starch were typical of the thermophilic flat-sour spoilage organisms isolated from sugar by Cameron. They measured from 2 to 5 mm. in diameter, presented a typical brown central spot and were in an acid field, as evidenced by the yellow halo. Sub-surface colonies were pinpoint type, and appeared brown in the medium. Several slow acid-producing colonies were picked for comparative purposes.

At the same time the analysis for thermophiles was made, similar plates were made and incubated at 37° C. (98° F.). They contained large numbers of colonies, a few of which produced acidity in the medium, though none were typical of the colonies described for the thermophilic flat-sour producing organisms. These colonies were 5 mm. or more in diameter, grey, membranous, some producing capsular material. Cultures were made from these plates and examined by the same technique used for the thermophilic organisms.

In order to test the ability of the organisms isolated to produce flat-sour spoilage, simple "cans" of food product were prepared, by squeezing whole-kernel canned corn, straining through cheese cloth and diluting with water in equal proportions. This juice was tubed in approximately 10 c.c. portions and covered with a wax which melted at 65° C. (149° F.). Thus anaerobic conditions similar to those existing in canned foods were produced. This "can" was sterilised at 15 pounds (121° C. [250° F.]) for 30 minutes. In later experiments whole-grain corn was used under wax seal. Spore suspensions of the organism were made from agar slants, and pipetted on the cold wax. The tubes were then placed in the Arnold steriliser just long enough to melt the wax sufficiently to allow the suspension to fall beneath the seal. By incubating duplicate tubes or "cans" at 37° C. (98° F.) and 55° C. (131° F.), the flat-sour producing ability of each original colony was observed at the two temperatures. After an incubation period of 5 days the wax plug was pushed below the surface of the solution and the acidity of the corn or corn juice observed by tasting and with brom-cresol-purple as the indicator. The results are indicated in the following table and represent isolations from the 20 samples of starch studied:

TABLE E.

FLAT-SOUR PRODUCING ABILITY OF ORGANISMS IN WHOLE-GRAIN CORN.

Number of Cultures Isolated.	*Isolated at*	*Tested at 55° C.*		*Tested at 37° C.*	
		Acid.	*No Acid.*	*Acid.*	*No Acid.*
61	55° C.	57	4	57	4
43	37° C.	0	43	7	36

The above table is a summary of the series of tests made on all organisms isolated at both 55° C. (131° F.) and 37° C. (98° F.). Included in the 61 cultures of thermophiles picked from the plates were 10 cultures which were slow acid producers, as indicated by lack of a definite yellow halo. As will be observed, all but four of these gave typical reactions when cultured in corn. For the samples of starch used all thermophiles isolated from typical colonies were definite flat-sour producers, whether incubated in "cans" of corn at 37° C. (98° F.) or 55° C. (131° F.). Thus it appears that those organisms isolated at 55° C. (131° F.) were facultative thermophiles. In testing the temperature relationships of these organisms, inoculations were made in corn juice or whole-grain corn without a wax seal. Under both conditions typical souring of the material occurred. Thus it appears the organisms are not only facultative thermophiles but facultative anaerobes as well.

Morphological and physiological study of thermophilic organisms isolated from these starch samples indicated that they were a fairly uniform group. They had the following index numbers, 52X1, 52220, 122 (2-3), based on the Society of American Bacteriologists' descriptive chart for 1920, which is somewhat different from subsequent charts.

General Characteristics of Organisms

Morphology: On plain agar they were straight rods, with rounded ends, occurring singly and in short chains and clumps.

Staining: Gram-positive in young cultures, with a tendency to become gram-negative in old cultures.

Spores: Spores in week-old cultures. They were terminal and subterminal, elliptical, some swelling at sight of sporulation.

Motility: Young cultures were definitely motile. No attempt was made to determine position of flagella.

Relationship to Oxygen: Facultative.

Temperature Relationships: Facultative thermophile.

Dextrose Agar Colonies: Round colonies, 2 to 5 mm. in diameter having opaque central spot.

Fermentation Reactions: Dextrose, sucrose and lactose fermented with acid and no gas.

Gelatin: No liquefaction.

Starch Agar: Extensive hydrolysis after 48 hours' incubation.

Nitrate: No reduction.

As indicated under temperature relationships, these organisms were definitely facultative thermophiles. In no instance with samples used were we able to isolate obligate thermophiles.

Cultures isolated from plates incubated at 37° C. (98° F.) represent an entirely different group of organisms. Some plates were completely yellow when observed after 24 hours' incubation, but became neutral after 48 hours. This change was due in many cases to spreaders which developed. Only those colonies which gave indication of acid production were selected for this work. All cultures isolated were tested in the same manner as those isolated from the 55° C. (131° F.) plates.

Results given in the table indicate that organisms of this group are mesophilic. When inoculated into whole-grain corn or corn juice and incubated anaerobically at 55° C. (131° F.) they failed to produce any change. At 37° C. (98° F.) 36 of 43 cultures studied failed to produce acidity in whole-grain corn under anaerobic seal. Most of these cultures produced acidity in dextrose broth and corn when incubated aerobically. It appears that they are aerobic spore formers. Morphologically and physiologically they gave reactions similar to organisms of the *Bacillus subtilus-mesentericus* group. They are probably of little significance in properly canned foods.

Seven of the 43 cultures isolated at 37° C. (98° F.) gave typical acid production in corn incubated anaerobically at this temperature. They failed to grow and produce acidity at 55° C. (131° F.). Thus they are mesophilic organisms, but differ from those in the above-mentioned group in their ability to produce acid in corn anaerobically.

Heat-Resistance Studies

Heat-resistance studies were made on this group of mesophilic organisms in order to determine their ability to withstand temperatures of canning. Spore suspensions were prepared from 7-day cultures grown on nutrient agar. As was expected, considerable variation in thermal resistance was obtained. Organisms of the *Bacillus subtilus-mesentericus* group were readily destroyed. A representative thermal death time for these organisms was 115° C. (239° F.) for 10 minutes. The spores of cultures giving acidity in corn anaerobically were more resistant. A representative thermal death time for these cultures was 115° C. (239° F.) for 30 minutes. Thus they show a resistance to heat comparable to thermal death times given for some of the thermophilic flat-sour organisms.

Discussion

Previous studies on the organisms from foods and from sugar have indicated that flat-sour spoilage may result from either facultative or obligate thermophiles. Results of investigations have not been reported in the literature on organisms from starch. Cameron and Esty (1926) studied extensively the morphology and physiology of thermophilic organisms isolated from non-acid foods. They concluded that their group of obligate thermophiles agreed sufficiently well with *Bacillus stearothermophilus* Donk that they could consider them identical. The facultative thermophiles which they isolated differed from Donk's organism. They did not attempt to name the organisms of this group. Work by Cameron and Williams (1928) on thermophilic organisms from sugar indicated that the same groups (facultative and obligate thermophiles) were present. A study of the temperature relationships of the thermophilic organisms indicated that of the 77 cultures isolated all but 16 were facultative thermophiles. The morphological and physiological characteristics of the 16 obligate thermophiles corresponded with those given by Donk for *Bacillus stearothermophilus*.

Facultative thermophilic organisms isolated in our work with starch gave practically identical reactions with those isolated by Cameron and Esty from non-acid foods and by Cameron and Williams from sugar. Thus it appears that these organisms studied are identical with the facultative thermophiles from sugar. Their characteristics differ from the organism isolated by Donk in that they develop both at 37° C. (98° F.) and 55° C. (131° F.) and are gram-positive. They cannot be considered then as *Bacillus stearothermophilus* Donk, which is an obligate thermophile.

In no case were we able to isolate thermophiles from starch. This does not mean they are never present, but rather if present they do not represent a predominant type. The fact that these organisms are facultative in regard to temperature is of considerable importance. Proper cooling of cans after processing will not completely eliminate danger of spoilage by this group.

Since there is considerable difference in the method of producing starch and sugar, some attention was given to the mesophilic organism obtained from starch. The

main types present were of the *Bacillus subtilus-mesentericus* group. Seven of 43 cultures isolated gave indication of acid production in corn at 37° C. (98° F.). They failed to grow at 55° C. (131° F.), so were definitely mesophilic, but produced spores more resistant to heat than most of our common mesophilic organisms. Their importance in food spoilage has not been fully studied at this time, but it appears that in some cases these organisms may be of significance.

Summary

Review of literature on presence of thermophilic food spoilage organisms in starch and sugar indicates that they are a source of contamination to factory equipment which may lead to food spoilage. Three types of thermophilic organisms have been isolated and described —namely flat-sour, thermophilic anaerobes and sulphide spoilage organisms. Methods proposed for the examination of starch and sugar, and standards of these products are reviewed. Since the introduction of methods and standards great improvement has been made in the bacteriological quality of these materials for canners' use. This will be observed by comparing the analysis of samples for 1928 with the results of similar analyses made in 1937.

Storage of sugar results in a decrease in the numbers of thermophilic flat-sour spores. Samples of sugar which contained more of these organisms than permitted by the standards show, after 6 to 8 months' storage, sufficient decrease in flat-sour spores to conform to the standards. Though no data is presented, laboratory observations have indicated a similar decrease in stored starch.

The mesophilic organisms from starch are mainly of the *Bacillus subtilus-mesentericus* group. A few cultures isolated at 37° C. (98° F.) differed from other mesophiles in that they produced acidity in whole-grain corn under anaerobic conditions. They did not develop at thermophilic temperatures. Since their spores show considerable resistance to heat there is a possibility that under some conditions they may be of significance in food spoilages.

The thermophilic flat-sour organisms isolated from starch samples were all facultative thermophiles. They are similar both morphologically and physiologically to this type of organism isolated from sugar. In no instance were obligate thermophilic organisms producing flat-sour spoilage isolated. If they are present they do not represent the predominant group of thermophilic food spoilage organisms in starch. Thus the organisms studied in this work would not be classified as *Bacillus stearothermophilus* Donk, which is an obligate thermophile; rather they belong to the unnamed facultative thermophilic group of spoilage organisms described by Cameron from sugar.

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ERRATA

In Part I, Table B, Col. 3, fifth line from bottom, should read *p*H 7·0, and last line should read *p*H 6·8.

Book Review

FIVE CENTURIES OF ENGLISH DIET

A Notable Book

The Englishman's Food. *J. C. Drummond, Professor of Biochemistry, University College, London, and Anne Wilbraham.* 574 *pp.* 16 *illustrations.* 12*s.* 6*d. net.*

It is a truism that the proper approach to social and international problems is by way of history. This book by Professor Drummond and Miss Anne Wilbraham is, as they put it, an attempt to present a picture of the changing character of English diet during the past five centuries against a background of social and economic history.

Not only is this work valuable to students of these matters, but also to those interested in the problems of nutrition. It is one which should be on the shelves as a valuable reference book for all interested in diet, and who of us is not?

Many historical questions which may have puzzled even the dietitians and the scientists are answered here. The knowledge of vitamins is a new and still incomplete thing. The account of the attempts to overcome scurvy, especially during long sea voyages, is a story full of fascination. Its terrible effects are graphically told through quotations from contemporary literature.

Scurvy was said in 1724 to be a "kind of Catholick (universally prevalent) Distemper here in Britain". But from 1720-60, when the common garden vegetables and fruit were comparatively cheap and plentiful, the authors have traced little information that gives them any clue to the incidence of scorbutic conditions. Doubt is left whether or not the mild scurvy which had afflicted England for hundreds of years was markedly less apparent in the eighteenth century than previously. With regard to "sea scurvy", this was dramatically eliminated in an empirical way by 1806 when there was one case in the Naval Hospital at Haslar. In 1760 there had been 1,734 cases and in 1806 there were none.

This was nearly two hundred years after Captain Lancaster had proved the value of lemon juice as an antiscorbutic. In a voyage to the East Indies, "he brought to sea with him certaine Bottles of the Juice of Limons, which hee gave to each one, as long as it would last, three spoonfuls every morning fasting; not suffering them to eate anything after it till noone". Impressed by the experiences of these first two voyages, the East India Company arranged for a supply of lemon water for all its ships.

The whole story of scurvy (the authors devote two separate chapters to it) interests from different points of view and demonstrates how man often stumbles upon cures for his ills without possessing the necessary scientific knowledge to know exactly why. The state of the world to-day suggests the thought that perhaps we are similarly stumbling in political science and that somewhere deep down lies the panacea for these ills?

* * *

The present generation are definitely taller than their grandparents. The average height is now steadily rising and it is a rather interesting fact that it appears to be increasing at the fairly steady rate of 0·4 inch every ten years. So far as we can tell, this change has been in progress a good deal less than a hundred years, and it may date only from the period, about fifty years ago, when greater attention was given to public hygiene and the effect of different kinds of food, particularly that of infants and children. It is certain that the average stature of Englishmen remained practically unchanged from the earliest times until within living memory. The authors give the evidences for this in their chapter on rickets. It would seem that here we have an excellent opportunity for applying height statistics to the task of assessing the point at which proper diet becomes more or less universal. Obviously the average height will not go on increasing until we are a race of giants, which would not take long if the aforementioned ten-yearly increase continued.

* * *

In addition to its many far-reaching results, the industrial revolution was one of the causes of the deterioration of physique among the poorer people. The increasing employment of women in factories and workshops coincided with the decline in breast feeding for children. It also seems probable that the hard conditions of life, particularly during the bad periods, were responsible for a great many women not being able to nourish their children naturally. In former times most of these children would have died, but as the nineteenth century passed an increasing proportion were successfully reared by artificial means. The authors' chapter on the Deterioration of Physique discusses this and other matters in a stimulating manner, and their word of warning regarding the practical significance of mild vitamin deficiencies—*e.g.*, that of vitamin B_1—may be well taken to heart.

* * *

Turning to the twentieth century, it is perhaps only by referring back to its beginning that we can estimate the tremendous advances in the science of nutrition that have taken place during the past forty years. In 1900 "little was known about the influence of bad diet on health". It required a war to demonstrate the state of affairs. Sir William Taylor, Director-General of Army Medical Service, produced a flutter in Whitehall as a result of his memorandum in which he reported that the Inspector of Recruiting was having the greatest difficulty in obtaining sufficient men of satisfactory physique for service in the South African War. The rejections in some areas were as high as 60 per cent., and over the whole country nearly 40 per cent. The chief grounds were bad teeth, heart affections, poor sight or hearing and deformities. As in the case of much later investigations, much of the "errors" of diet were due to sheer poverty.

When dealing with bread and the recent proposals for incorporating a much larger proportion of yeast, particularly of special cultivated "high-vitamin B_1" yeasts, the authors deplore the lack of interest evinced in the matter by the baking trade.

The last section of the book affords a very good picture of the trend of research on nutrition at the present day. By extremely judicious selection this section is extremely well balanced (not a universal virtue in this class of literature!) and may well form a short reference book on the subject.

* * *

The Englishman's Food has the attributes of the "bedside book". It may be opened at any page and perused with both profit and pleasure. The authors seem to have picked from the literature of five centuries the essential elements of the subject. The extracts from the literature of the different periods are delightful to read, and the authors may be congratulated on the result of their industry and scholarship. Apart from other potential readers, it is certainly a book that anyone connected with the food industry should possess.

T. C.-W.

MACARONI

From a Canadian Correspondent

THE EMPIRE tariff preference has given the Canadians the opportunity to displace other countries, chiefly Italy, as our principal suppliers of macaroni, and, as the following figures show, they have seized it with both hands.

Canadian Product Makes Good

Our average total imports of macaroni are a little over 100,000 cwt. per year, but whereas in 1933 Canada's share was 26 per cent. of our imports, in 1938 it had risen to 54 per cent., while Italy's share in the same period fell from 35 per cent. to 8 per cent. There is little or no difference in the quality of the products of the two countries, but the difference in price on the British market is about 10s. per cwt. The demand for Italian macaroni is confined largely to Italians in this country who insist on using their native product. The Belgians have also increased their share of the market considerably, though it is still only about 12 per cent., while the French are just holding their own.

The Canadian food laws are probably the most stringent in the world, and all food factories have to conform to regulations covering lay-out, sanitary conditions, and methods of operation. Canada is also a large producer of amber durum wheat, which is most suitable for the production of macaroni, as it combines strength with a most desirable creamy colour.

For the production of macaroni products of good quality the best grades of semolina or farina are used, though some makers use a 95 per cent. hard winter flour.

The best macaroni is hard, brittle, translucent, and a bright amber colour. It should break with a clean, glassy fracture. The cheaper types made from bleached flour will be white and break with ragged ends.

Dough-Making Process

Manufacture begins with the dough-making process. For every 100 lb. of semolina or farina 26 to 30 lb. of water are added at temperatures which vary between 70° and 140° F. The quantity of water varies with the product to be made, less water being used for vermicelli than for macaroni. Sometimes salt is added. The dough is mixed for 10 to 20 minutes at a temperature of about 104° F., then transferred to a kneading machine similar in size and action to a butter worker. To produce a uniform smooth, stiff dough takes 10 to 20 minutes kneading.

From the kneader the dough is transferred to the press which is maintained at 104° F. to keep the mass plastic. Under pressures up to 5,000 lb. per square inch, it is forced through a perforated plate.

For macaroni the perforation has a small pin in the centre which forms the hollow tube. The supports of the pin divide the dough, but the great pressure used reunites it as it leaves the die. In making the solid rods of vermicelli the dough is forced through a similar die without the pin. Vertical presses are generally used for long-cut macaroni and horizontal presses for the smaller pieces. Revolving knives are used to cut it to sizes as it leaves the die. For fancy shapes the dough is rolled into thin sheets and dies are used to stamp the figures.

Drying Determines Quality

The drying process which follows really determines the quality of the product. It can be carried on in the open air as in some plants in Italy, or in specially designed air-conditioned chambers. While it may be objected that a product dried in the open air is exposed to dust and contamination, it should be remembered that macaroni products are always boiled for at least ten minutes before being eaten.

The long strips are hung over rods and the smaller pieces placed on trays preparatory to drying, which takes from 36 to 90 hours. The product is given a preliminary drying of about 2 hours to prevent the development of mould. Then in order that the rods, tubes, or shapes should dry uniformly and to prevent the outside drying faster than the inside, they are placed in a humid chamber to make the moisture content the same throughout. This also brings out the flavour. The drying chambers are supplied with purified air constantly renewed and regulated as to humidity and temperature. The temperatures used range from 70° to 100° F.

When boiled the macaroni should retain its shape, though it absorbs about three times its weight of water. According to Hutchison, it is about eight times poorer in nitrogen than a similar weight of beef. During digestion it is almost entirely absorbed by the digestive tract and is given in conditions where it is advisable to leave behind as small a residue as possible in the intestine.

Canning in War-Time (*Continued from page* 32)

out any very apparent deviation from the normal except for the increase of production of special goods.

SOME SUPPLIERS TO MACONOCHIE BROS., LTD.

Can Washers : *Hobart Manufacturing Co., Ltd.*
Exhausters : *G. C. Engineering Co., Ltd.*
Automatic Control for Exhausters : *Sarco Thermostats, Ltd.*
Caps for Bottles : *Wallis Tin Stamping Co., Ltd.*
Tins : *Metal Box Co., Ltd.*
Double Seamers : *Metal Box Co., Ltd.*
Jacketed Pans : *Aluminium Plant and Vessel Co., Ltd.; Wm. Brierley, Collier and Hartley, Ltd.*
Labelling Machines : *" Beth " Label and Wrapper Machines, Ltd.; Purdy Patent Machinery Co.* (1939), *Ltd.*
Trucks : *H. H. Stark, Ltd.*
Retort Controllers : *Short and Mason, Ltd.; Foxboro-Yoxall, Ltd.*
Retorts : *John Fraser, Ltd.*
Lacquering Machine : *Aerostyle, Ltd.*
Vegetable Cutters : *J. C. Wetter and Co.*
Meat Hooks : *Lockerby and Wilkinson, Ltd.; Brockie and Crowther, Ltd.*

NEWS FROM THE INDUSTRY

PLANT AND EQUIPMENT

V-Rope Drives

Makers of chocolate, and foodstuffs in general, are, of necessity, scrupulously careful to avoid even the slightest possibility of contamination of their products whilst undergoing manufacture. The cleanliness, silence and smooth running of V-Rope Drives makes a distinct appeal, but it is essential that not the slightest particle of rubber shall be thrown off the ropes when in operation. J. H. Fenner and Co., Ltd., claim that their standard type "Fenner" V-Ropes have no free rubber whatever on their outer jackets and can thus be used on chocolate machinery with every confidence.

On some machine drives it is vitally necessary to avoid even the slightest chance of rubber particles being abraded from the V-Ropes, and a Dry Cotton V-Rope has been developed which has no rubber whatever on its outer surface.

Besides containing a description of V-Ropes for specific industries, the firm's new catalogue includes a set of drive tables printed on blue paper, a quick reference centre distance chart, and details of the V-Rope and pulley stocks which are at their branches.

* * *

Industrial Pass-Out Turbines

For a number of years past a pronounced tendency in many industrial establishments has been to replace the standard horizontal, large, slow-speed, compound main engine by steam turbines. For this purpose the same baseplate and rope drive or other existing equipment can be used, as well as the same boiler plant, causing the minimum amount of trouble during the change-over. The result is to give much higher thermal efficiency in the case of a condensing turbine, whilst a further substantial economy can be obtained by operating the turbine on the pass-out (or back-pressure) principle for the provision of low-pressure "boiling" and heating steam required in the food and many other industries. A turbine also is easily arranged to drive at the same time an electrical generator, direct through reduction gearing, supplying current for both lighting and power, and has in addition the well-known advantages of small weight and space, noiseless running free from vibration, and very easy and efficient governing. In addition, the turbine can easily be installed to take a much higher steam pressure and temperature of superheat when the time comes to replace the boiler plant. Well known in this field is Hick Hargreaves and Co., Ltd. In 1923 they commenced the manufacture of industrial impulse steam turbines in sizes from 20 h.p. (or less) up to 4,000 h.p. of the condensing, back-pressure, pass-out and mixed-pressure types as well as condensers of all sizes.

* * *

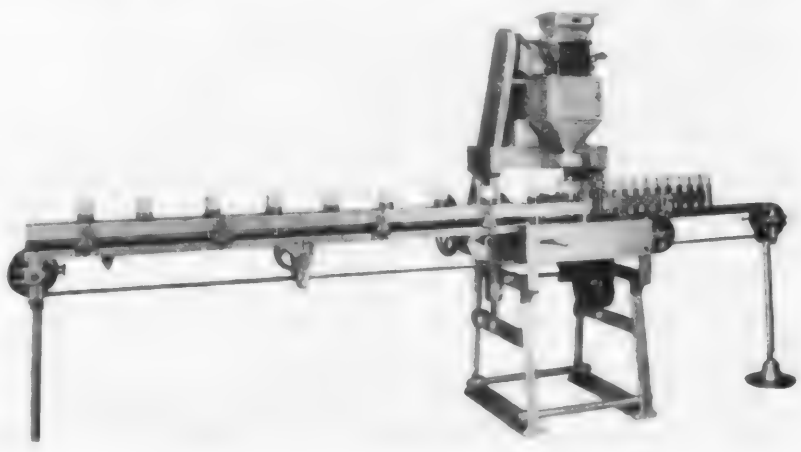
Automatic Tin Conveying, Filling and Vibrating Machine

This is one of the latest productions of the Automatic Weighing and Packing Machine Co.

Lined tins are conveyed either from a lining machine or, after being lined by hand, are brought to the weighing point and are automatically fed beneath the filling nozzle. By an arrangement of suitable cams the nozzle is lowered into the bag while the filling takes place and is gradually withdrawn, succeeding tins eject the filled tin on to a discharge conveyor and the material is vibrated down to the required level ready for folding and lidding.

The speed of a single unit is 25 per minute, but a combination of twin, triple or quadruple units are made to give speeds up to 100 per minute.

In the case of the installation illustrated an additional unit has been provided for folding the bags and lidding after filling.



Cranes and Runways

Reducing costs is always a business man's dream, but the problem of reducing "on costs" is always the business man's nightmare. "We have reduced 'on costs' in 97 per cent. of the cases put before us. For instance, one of our friends wanted to know how two overhead cranes could pass one another on the same gantry. Our answer was that they couldn't. But we solved the problem all the same." This and several other interesting cases are described and illustrated in a little booklet issued by Aabacas Engineering Co., Ltd.

Among the jobs they handle are overhead cranes, runways, electric hoists, conveyors, goods lifts, stackers and special appliances.

* * *

Food Plant

A very extensive range of plant for food manufacture is covered by a new set of catalogues issued by Aluminium Plant and Vessel Co., Ltd., who manufacture equipment in nickel, Monel metal, stainless steel, copper and aluminium.

An interesting item is the Electric Tarbet Positive Holder, which was designed in anticipation of the milk pasteurising requirements of the Ministry of Health. This pasteurising equipment is fully described in Booklet No. 218. Other types of pasteurising plant are also described in other booklets, and still others cover steam-pans, tanks for milk, and leak-proof fittings, such as cocks, tees, unions, etc. Those

PLANT AND EQUIPMENT

handling operations involving the transport of liquids will certainly be interested in the latter-named publication.

* * *

New Gas Producer

By the intensive development and manufacture of the new Brush-Koela Duo-Draught Gas Producer, "Brush" once again adds worthily to its comprehensive range of world-renowned products, which include turbo-alternators, electric motors, generators, internal combustion engines and passenger coachwork.

Since the beginning of the century isolated pioneers in many countries have attempted to popularise the Portable Gas Producer for use on various forms of road transport vehicles.

The solution of the problem was rendered vital by the outbreak of war, as a Gas Producer using coal and coal-derived fuels enables road transport to be maintained with less petrol and oil.

The development of gas producers in this country, previously hampered by Government regulations, has received a healthy fillip by the recent relaxation of these, and several new firms, in addition to long-established concerns, are now engaged in the manufacture.

The new gas producer is now being made in large numbers at the works of the Brush Electrical Engineering Co., Ltd.

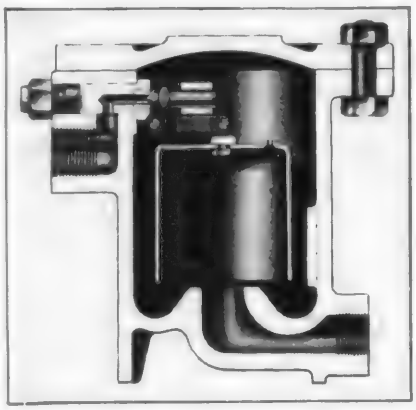
This unit incorporates several remarkable new features and improvements over earlier designs, which are explained and illustrated in Publication No. K99, obtainable on request from the Company.

* * *

Steam Traps

A comprehensive range of steam traps, which include in their range the Sirius, Cosmopolitan, Autovent, Dome and the Slik, is offered by Holden and Brooke, Ltd.

Possibly the trap which has the most universal appeal for the majority of installations is the Dome, a section of which is shown herewith, and which is made in six sizes to suit ½-in. to 1½-in. pipes, among these being the new and very popular Dome Minor, which, although compact and very low priced, has a large capacity and is of first-class specification throughout. These traps are suitable for all pressures up to 200 lb. per square inch. They give a positive action, their design precludes the possibility of air lock in



pipes, and they will lift their discharge. As such they are eminently suitable for all process work in the manufacture of foodstuffs, and the firm's 46 years' experience in the manufacture of steam traps ensures a thoroughly reliable article giving long trouble-free service.

Messrs. Holden and Brooke, Ltd., are also manufacturers of centrifugal pumps, feed-water heaters, liquid meters, exhaust heads, ejector heaters, etc., large numbers of which are in use in the food industry.

TRANSPORT

Electric Battery Vehicles

The past twelve months have been devoted by Metropolitan Vickers Electrical Co., Ltd., in the main to detail improvement of the standard range of vehicles, but of special additional interest has been the development and putting into production of a new model having a pay-load capacity of 25/30 cwt. The standard range, therefore, now comprises four chassis with pay-load capacities of 7/9 cwt., 10/14 cwt., 18/22 cwt. and 25/30 cwt. respectively.

The new model is available in long and short wheel-base designs, the latter being recommended for general transport purposes, and the former for those cases where the load to be carried is of a bulky nature, such as laundry or furniture.

There has been a considerable increase in the demand for electrical vehicles during the present year. In the early part of the year the imminence of war and the possibility of petrol restrictions arising therefrom focussed attention on this alternative means of transport. The demand for electric vehicles has, of course, increased enormously since the early part of September.

* * *

Gas or Steam Driven Vehicles

Lower rates of taxation on goods vehicles driven by gas or steam are set out in the Gas and Steam Vehicles (Excise Duties) Bill, which had effect from January 1.

The amended rates of duty proposed for vehicles not exceeding a ton and a half in weight unladen are: Not exceeding 12 cwt., £10; over 12 cwt. but not exceeding one ton, £15; over one ton but not exceeding a ton and a half, £20. In each case the weight is the figure unladen.

In computing the rate of duty chargeable, reductions are allowed for in the unladen weight if the vehicle carries a gas container or gas-producing plant. Where the weight unladen exceeds 12 cwt. but not three tons, the reduction is half a ton; over three tons but not six tons, three-quarters of a ton; and exceeding six tons, one ton. Allowance is also made for cases where a goods vehicle has a trailer for a gas container or plant. "Gas" is held to mean any fuel which is wholly gaseous at 60° F. under a pressure of 30 ins. of mercury.

INSTRUMENTS

Gauges and Recorders

Such instruments as depth gauges, level recorders, level and depth alarms and controls are illustrated and described in *Level Measurement and Control*, issued by Negretti and Zambra. This book is intended to become a reference book for those who are responsible for the selection and installation of level measuring instruments. The illustrations have been supplemented with accessory schedules and diagrams showing how the various models are employed, together with some details of erection. The range extends from the simple outfit giving a single spot reading to the continuous indication or recording of a number of points with the addition of automatic alarms or control. Their uses cover the requirements of those interested in the measurement of level, depth or volume in hot- or cold-water tanks, boreholes, reservoirs, sludge digesters, drainage sumps, etc.

The manufacturers claim for their instruments correctness of principle and simplicity of detail, ensuring a lengthy service-giving life for a minimum maintenance cost.

SOCIETIES

Society of Chemical Industry

It is announced that there will be a joint meeting of the Chemical Engineering Group and the Food Group on April 12, when a paper on "Chemical Engineering Problems in the Canning Industry" will be read by T. W. Jones.

The conference on "Vacuum Plant and Pumps" which was to be held in February has been postponed owing to the difficulty of obtaining and of publishing suitable papers on the subject owing to present conditions, and it has been decided to postpone the conference until more settled times allow full justice to be done to a topic of such widespread interest.

Mr. W. E. Callingham was to have read a paper on "Continuous Beet Sugar Diffusers" at a joint meeting with the Birmingham Section, but he was obliged to withdraw at short notice. It is hoped, however, that it may be possible for it to be presented at a later date.

Another interesting paper, the reading of which had to be abandoned owing to pressure of work, was "Maintenance and Control of Gas Storage for Foodstuffs", by Dr. C. West and Dr. Franklin Kidd.

The paper on "Water Treatment and the Effluent Management of Boiler Plant" was read by the author, W. Hamer, at the Chemical Society's rooms on January 19.

LABORATORY MATERIAL

High-Speed Filter Paper

A new and faster filter paper has been evolved which will filter 5 ml. of water in 5 seconds. Previously the fastest filter paper made by J. Barcham Green and Son, was their 704, which filtered 5 ml. in 20 seconds. This new improved 904 hand-made filter is a considerable improvement on 704; it is about four times faster and its wet strength is approximately six times greater.

If a 38·5 cm. circle is folded and held under the laboratory tap, the water runs through the filter paper about as fast as it comes out of the tap, and the paper is so strong that it can be held between fingers and thumbs, full of water, without breaking. 904 is ideal for pressure, filter presses, and for hot or cold broths.

Samples may be obtained from local dealers, and the list of prices of 904 and various other ranges of filter papers are contained in List G issued by the makers.

COLD STORAGE

Conditioning Fruit by Refrigeration

In combating difficulties caused by irregular supplies and demand in the fruit industry, refrigeration is going to play an increasingly important part, and the trader who is equipped with efficient plant is naturally going to secure more profitable business.

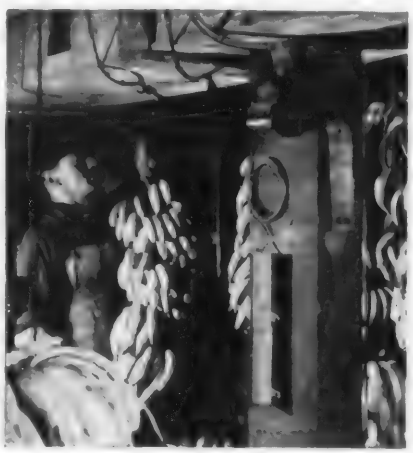
In district markets, for instance, refrigerating plant has been extensively used. A well-known firm of fruit and vegetable salesmen have installed a large underground store with Coldair refrigeration plant made by the General Electric Co., Ltd., which they use principally to condition bananas. This store consists of four rooms capable of holding 150 to 300 stalks of bananas. The rooms are insulated, and the fruit is suspended by ropes from hooks in the ceiling placed at regular intervals of about 2 feet apart to allow free air circulation.

A second air-conditioned room on the ground-floor level is used for the storage of practically all kinds of fruit and some vegetables.

The plant comprises a condensing unit of the twin-cylinder, reciprocating, single-acting, air-cooled type. It is charged with methyl chloride, and is worked by a 2-h.p. electric motor specially developed for refrigeration. The compressor and condenser are compactly mounted on a common cast-iron baseplate.

The two cooling coils fed by the condenser each have 9-in. air circulating fans, one unit being installed in the general fruit store and the other in the banana rooms.

The controls consist of a 2-h.p. starter, two thermostatic expansion valves and a low-pressure temperature control. Double-seated service stop valves are fitted on the condensing unit.



Banana stalks hung on the ceiling of the conditioning room. In the foreground the thermostat controlling the temperature can be seen mounted on a pillar.

FOOD PRICES

Cost of Living

The Ministry of Labour and National Service announces that at December 1, 1939, the official cost of living index figure was 73 per cent. above the level of July, 1914, as compared with 69 per cent. at November 1, 1939. The rise of 4 points (*i.e.*, from 169 to 173, the figure for 1914 being 100) is equivalent to nearly 2½ per cent.

For food alone, the index figure at December 1 was 57 per cent. above the level of July, 1914, showing a rise of 3 points, or about 2 per cent., since November 1, when the figure was 54 per cent. above the level of July, 1914.

The rise in the index figure for food was due mainly to increases in the prices of eggs, fish, bacon and cheese. Among items other than food, the principal changes were increases in the prices of clothing, coal and gas.

PERSONAL

Mr. W. L. Chard

Mr. W. L. Chard was recently appointed general manager of A. Walkling, Ltd., which controls a large chain of bakers and confectioners shops in the London area. Mr. Chard has held many important positions in the baking trade, having been manager to H. Garon, Ltd., Tilly's, Ltd., and Harrods, Ltd. His practical knowledge of bread, cakes, biscuit and chocolate manufacture will be useful in his new post.

* * *

New Chairman

Mr. Horace Wilson has agreed to accept the position of Chairman of the London Master Bakers' Benevolent Institution. The annual meeting was held at the Bakers' Hall on Monday, January 29.

* * *

Hampers for Troops

The Overseas League Hamper Fund, which was launched towards the end of November last, is being looked after by the League's Field Forces Fund, of which Lady Wrench, the wife of Sir Evelyn Wrench, C.M.G., LL.D., is Director-General and Secretary. Hampers costing 10s., £1 and £2 10s. are being sent, and these are supplied by a well-known firm who furnished eatables to the British troops before the Battle of Waterloo.

INFORMATION AND ADVICE

Meat Canning — Soya Bean Proteins — Gum — Liquid Cloud — "Apple Diet"—Egyptian Onions—Glacé Cherries—Chewing Gum

Meat Canning

5,675. *One of our customers has purchased a "retort" machine, which, we understand, is for the steaming or canning of meat. We would be pleased if you could give us any information in regard to the working of a retort machine for this purpose, such as the heats and the general process involved in the making of steamed or canned meat.* (Glasgow.)

We think that you could obtain the required information in our *Food Industries Manual*, which no doubt as subscribers you have received.

As a matter of fact, suppliers of plant will usually give all the information required as to the actual working of the retort itself.

We can give you no definite information as to the heats required for the sterilisation of canned meats, as this depends upon the nature of the pack and the size of the containers.

As apparently your customer is not familiar with this business, we should suggest that the best thing he could do would be to get into touch with an expert, who would be able to put their manufacture on a sure basis. The name of an expert was given.

Soya Bean Proteins

5,904. *Will you please inform me if the proteins of the soya bean are equal in food value to the proteins of meat?*

The soya bean, while having a high protein value, cannot be said to be equal to meat in this respect. A commercial soya bean flour contains about 50 per cent. protein and lean meat about 65 per cent. protein, calculated for comparison in both cases on the dry substance. Vegetable proteins in general lack certain amino acids which are found in meat, and the proteins are not so easily and completely absorbed. At the same time, soya bean is a valuable source of protein and it is asserted that it is of high biological value.

Gum

5,606. *We should be obliged if you could favour us with the address of the manufacturers or distributors of "Schis-Gum" or Cyprian gum.* (London.)

Doubtless you mean "Schiraz-Gum", which is a gum arabic insoluble in water but soluble in the stomach.

The name of a supplier of this material was given.

Liquid Cloud

5,762. *Can you give us a recipe for a "liquid cloud" to add to syrups for cloudy drinks, which will hold in the finished drink and not settle?* (Bradford.)

This is a trade secret, and we think that you could not do better than obtain the ready-made product from the manufacturers (name given), who market the cloud under a trade name.

However, perhaps one of our readers could help.

"Apple Diet"

5,891. *In the July, 1939, issue of* Food Manufacture *there appeared an article entitled "The Apple Diet". In this article the works of a Mr. Spencer were mentioned. Ten years ago he was supposed to have shown that jelling will take place just as well in an alkaline medium as in an acid medium. We here at Mass. State College believe that the acid medium is the more important factor; consequently we would appreciate a new theory or idea on the subject.*

Would you please send me all the information you have on the work of Spencer—any bulletins, reports, etc.? I would greatly appreciate this. Any other material you might have would be gratefully received.

I am a student just beginning in the field of Food Technology. The subject of jelling in canning greatly interests me. A report of Spencer's work on this subject would naturally be helpful to me. (Amherst.)

The work of Spencer was referred to in a note in the *Lancet* (London), May 6, 1939, p. 1082, and the actual reference to Spencer's paper is given in connection with that of Corsonello, who confirmed Spencer's findings. The reference to Corsonello's work is *Minerva med.*, Rome, 1938, vol. 29, p. 590, and that of Spencer's paper is J. G. Spencer, *J. Phys. Chem.*, 1929, 33, 1987.

Egyptian Onions

5,731. *We find that after a time Egyptian onions ferment and go milky. Please let us have a remedy for preventing this. It only occurs with Egyptian onions.*

It is impossible to diagnose the trouble without an investigation, and the problem is probably one for the bacteriologist.

We suggest that you send some samples of the original onion and also of the other materials you use to a bacteriologist.

Glacé Cherries

5,862. *Kindly inform us what quantity of glacé cherries can be obtained, say, from 1 cwt. of cherries in brine. Also, if possible, indicate where we can obtain particulars of the preparation of glacé cherries.*

We published an article in August of 1936 on the bleaching, dyeing and glacéing of cherries.

Chewing Gum

5,914. *Some time ago you published an article in one of your food journals on the manufacture of chewing gum, and we should be glad to learn if it is possible that you can trace this particular article, and if you could let us know if you have the date of the journal in which the article was published. We believe it was about a year ago.*

If you have it, would you let us know, because we shall then ask you to send it to one of our friends in Holland?

If you cannot find it, would it be possible that you could let us have a recipe to make chewing gum?

The article on the manufacture of chewing gum appeared in the August, 1937 (p. 268), issue of FOOD MANUFACTURE.

Information Supplied

5,653. *I am a regular reader of your journal* FOOD MANUFACTURE, *and should be glad if you could give me the addresses of some manufacturers of plant for making starch and glucose.* (Cairo.)

The names of manufacturers were given.

5,636. *A continental firm is intending to establish a factory for the manufacture of lard.*

We would be obliged if you could recommend a firm whom we can approach for an estimation for machinery necessary for the process of manufacturing purified lard. (London.)

The names of manufacturers were given.

5,605. *I should be pleased if you would give me information regarding the following: I wish to purchase a hand machine which will be portable and capable of stamping numbers of packages for dating purposes. The machine must be automatic in that it counts the number of packages stamped.* (Hull.)

The name of the manufacturer was given.

5,646. *We should be obliged if you could suggest some British manufacturers to send us information and samples for:*

1. *Patented metal caps for jam jars (clip-on, sure-grip).*
2. *Fancy papers for confectionery boxes, etc.*

(Lisbon.)

The names of the various British manufacturers were given.

5,647. *In your magazine* FOOD MANUFACTURE, *replying to the question No. 4,754, you mentioned that you had given to the enquirer the names of suppliers of plant for canning chickens.*

Will you please send us a copy of the list with these names? (Moscow.)

The list of names was given.

5,588. *We have a request before us, from one of our clients, to obtain and furnish the necessary particulars and specifications of machinery for a bakery to be started shortly.*

Can you give such information or have manufacturers at your end supply us with specifications and best export trade prices of:

(1) *Electric kneading and mixing machine for bread making, A.C. supply, and capacity 100 lb. at a time.*

(2) *Oven for baking the bread, either electric- or steam-baking.*

Prices should be C.I.F.C.I. net Karachi port. (Calcutta.)

The name of manufacturing firms were given.

5,892. *We enclose a sample of pudding basin of which we are huge users; the firm who usually supply us have informed us that they cannot supply us with any more owing to the Government control of aluminium, and we find this information verified on application to other firms who manufacture a similar article.*

Therefore, we are asking you if you could put us in touch with an American firm who manufacture these articles, from whom we could import our supplies.

No doubt aluminium in bulk form is not permitted to be imported except for armament purposes, but as these pudding basins are a domestic article which we use for the manufacture of our own products, and it is necessary to keep our factory and a large staff employed, we would probably be exempt from these regulations.

If you could put us in touch with an American firm, and give us particulars as to whom we should have to apply for permission to import, we would be very grateful.

The enquirer was referred to a British firm.

5,867. *Do you know of any firm that supply machines for washing horseradish root, please?* (Dover.)

The name of a supplier of such a machine was given.

5,798. *Would it be possible for you to let me have the names of cardboard box manufacturers who could supply me with the type of biscuit box which takes the place of the standard square 10-lb. biscuit tins?*

The names of a number of suppliers were given.

Information Required

5,955. *I should be greatly obliged if it is possible for you to give me any information with regard to a process for curing lemon peel known as "Donachie's", and I understand this is carried out by means of a vacuum kettle.*

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RECENT PATENTS

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

Improvements in or relating to the Preservation of Animal Flesh Products

The protection of meats, fish and poultry and particularly the protection of such products against oxidative deterioration, such as rancidity and protein decomposition, and according to the invention this protection is obtained by covering the entire surface thereof with crude soya bean oil or crude oat oil. This may be done without necessarily inducing any apparent change of the surface appearance of the flesh products.

The products protected in accordance with the present invention may include bacon, hams, pork, beef, fat backs, etc., whether in whole or in sliced form; poultry, such as chickens, turkeys, etc., and particularly those prepared for refrigeration and for storage; and fish, such as salmon, herring, sardines, mackerel, etc.

Bacon may be treated prior to the curing operation, or the bacon slices may be individually treated at the time of the slicing operation.

For example, in carrying out the latter, all that is required is that the slicing machine be equipped to provide means for applying a bath of the crude oil to the cutting blade prior to the slicing operation, whereby during slicing the sliced pieces are directly given a coating of the crude oil.

In the case of fish, the fish may be treated at the time they are caught or after cleaning, or immediately before freezing, or following the curing operation or following smoking.

Poultry may be treated prior to being placed in refrigeration for storage. Fresh meats may be treated at the time of slaughter, or at any stage of the storage period.

The crude soya bean or oat oil may be applied in the form of a direct spray, as by spraying crude oat oil or crude soya bean oil over the sliced bacon, poultry for refrigeration, etc. Or they may be coated by merely brushing the oil over the surfaces of the meat or fish.

The spraying of expressed crude soya bean oil over bacon, utilising the oil in the form of an atomised spray, thereby thoroughly coating the surface of the bellies, and resulting in at least some penetration, has been found to retard oxidative rancidity to a point where such bellies can be held for approximately a 50 per cent. longer period of time before developing objectionable oxidised odours and flavours than would be true of the untreated bacon bellies. The spraying of crude oat oil over mackerel prior to freezing, or over salmon prior to canning, has been found materially to retard the development of fishiness as determined by organoleptic and chemical tests.

This utilisation of the crude soya bean or oat oil will not only retard oxidative rancidity, but particularly in the case of fatty fish will retard protein decomposition as well.

515,481. Musher Foundation, Incorporated.

Machines for Shaping and Cutting-out Biscuits

This invention relates to a cutting machine for flat pieces of paste with a cutting out mechanism (cutting out and ejecting block with supporting table), alternatively moving first with the conveyor band for the strip of paste and at the same speed as this band and then returning in raised position quickly into its initial position.

To enable with very economical means such a machine to be rapidly converted into a paste shaping machine in which the conveying mechanism present in any case, the feed band and the oven are also required, it is proposed, according to the invention, firstly to construct the ejecting block as a flat carriage positively reciprocable in a concave track curved to a large radius, secondly to arrange the said curved double track vertically shiftable intermittently in the machine, thirdly to allow the ejector vertically shiftable within the carriage to be influenced by a cam shaft journalled in the body of the carriage and rigidly carrying a lever whose end is positively shiftable in an approximately horizontal guide adjustable in height, and fourthly to arrange in the machine frame bearings for a shaping cylinder, a pressure feeding roller for the paste and an elastic pressure roller acting on the under side of the conveying band.

All these constructional and arrangement features jointly produce the condition necessary for a rapid conversion of the plant from the production of cut-out wares to shaped wares and from shaped wares to cut-out wares.

515,649. Walter and Bruno Casaretto.

Latest Patent Applications

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32157. Pyke, M.: Production of flour or meal from cereals.

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Complete Specifications Accepted

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

13767. O'Connell, J., and Kerr, H.: Apparatus for making butter or treating like substances. May 11, '37.

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